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THE AMANITAS OF THE EASTERN UNITED STATES.*

By W. C. Coker.

The observations on living plants for this study have been made, with few exceptions, in the environment of Chapel Hill, N. C., and all collections listed with numbers are from Chapel Hill and all distribution localities mentioned are from North Carolina unless the contrary is indicated. About thirteen miles from Chapel Hill is Hillsboro, where the Rev. M. A. Curtis did a large part of his work on fungi near the middle of the last century; and about eighty miles to the west is Winston-Salem, where Dr. Lewis David von Schweinitz was opening up the untouched field of American Mycology one hundred years ago. Records for Asheville (Beardslee) are taken from the Journal of the Elisha Mitchell Scientific Society 24: 115. 1908, and from correspondence; for Blowing Rock (Atkinson) from the same Journal 9: 98. 1892, and from the Cornell herbarium; for Flat Rock (Memminger) from correspondence; for the State at large or its districts (Curtis) from the Geological and Natural History Survey of North Carolina, Part III. 1867. The photographs and drawings have been made by me, and one of my students has inked in the pencil drawings. My niece, Miss Gladys Coker, painted the colored plate. Many of the spore measurements have been made by Mr. Totten and Mr. Neely, of the Botanical Department, but all the measurements accompanying the spore drawings have been made by me. I have thought it a convenience to students to add a borrowed description of the one species from the Eastern United States that seems to me good, but that I have not seen alive.

While many of the Amanitas are edible, others are so poisonous that one should take no chances with any of them. Even if con-

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vinced that a species is correctly determined and is reported edible one should always test it in small amounts before eating it in any quantity. The importance of caution is further emphasized by the fact that many of the Amanitas that are regularly eaten have been found by experiments on animals to contain small amounts of a deadly poison, and it is altogether possible that the amount of this poison may vary in different localities.

In determining the identity of the Berkeley-Curtis species, a none too easy task with inadequate descriptions and often poorly preserved material, it has been necessary for me to examine the Curtis Herbarium at Cambridge, and to Dr. W. G. Farlow I am under many obligations not only for the unusual courtesy of opening the herbarium to me in the summer, but also for repeated gifts of typical spore material. I am also greatly indebted to Dr. Geo. F. Atkinson, of Cornell, for much help during my early struggles with mycology, and for his generous treatment at all times during my several visits to Ithaca. Dr. W. A. Murrill, of the New York Botanical Garden, has given me much assistance for a number of years, and I have imposed too often, I fear, on his well-known good nature. It has been necessary to examine the types of Prof. Peck's species at Albany, and to Dr. Homer D. House, the State Botanist of New York, I am grateful for repeated loans of type plants and for other thoughtful courtesies during my visit to Albany. Professor Beardslee, of Asheville, has generously given me several European plants which have been of use in studying our species.

In order to present in a simple way the probable relationships of the species of Amanita I give below an outline of six groups that expresses their natural classification as it appears to me at present. A fuller knowledge may considerably modify our ideas of these relations:

GROUP I. Volva large, sac-like, apically dehiscent, persistent, attached at very base of the stem, which is distinctly hollow and not at all bulbous; cap margin striate. Some edible; some said to be poisonous.

A. Cæsaria.
A. spreta.
A. recutita.

GROUP II. Volva sac-like, apically dehiscent, persistent (tending to break up in the southern form of *A. phalloides*), fused with the stem for some distance; stem solid, or, if slightly hollow, without a distinct central cylinder; cap margin even; veil thin and not friable. Probably all poisonous.

A. porphyria (?).
A. phalloides.
A. verna.
A. hygroscopica.
A. magnivelaris (?).
A. mappa.

GROUP III. Volva fused with the bulb, breaking up into warts on the cap, on the bulb forming flakes, lines, warts, or a truncate roll; stem stuffed or hollow, bulbous; veil thin, not friable; short gills truncate at the inner end. *Amanita muscaria* is poisonous, *A. cothurnata* possibly so and *A. gemmata* is harmless.

A. gemmata.
A. cothurnata.
A. muscaria.

GROUP IV. Volva breaking up completely into warts on the cap, and into obscure lines, fibers or scales on the stem base; veil thin, delicate, not friable; stem more or less bulbous, never completely hollow, and with no central cylinder; margin not striate or slightly so. Short gills not truncate at the inner end. Some, and possibly all, edible.

A. spissa.
A. excelsa.
A. rubescens.
A. flavorubescens.
A. Frostiana.

GROUP V. Volva remaining on the cap as firm warts, not noticeable on the stem base or only slightly so as lines. Veil very thick, compound, not friable, attached to the stem for some distance by strong fibers; stem solid, bulbous. No odor of chloride of lime. All edible.

A. solitaria.
A. abrupta.

GROUP VI. Volva remaining on the cap as firm warts or as a friable meal, scarcely noticeable on the stem base or appearing there as a friable meal, or (in *A. virosa*) forming a low cup; veil ample but very friable and fragile, usually breaking into pieces and falling away in expanding, mealy on the under side, attached to the very apex of the stem; stem solid, bulbous. Plants with a distinct odor of chloride of lime (old ham). Some edible, some perhaps poisonous.

A. strobiliformis.
A. chlorinosma.
A. Atkinsoniana.
A. virosa.
A. magnivelaris (?).
A. cinereconia.

AMANITOPSIS

Usually solitary. Cap fleshy, fragile; glabrous or farinose, or with flat patches of the volva, usually striate on the margin. Gills free or just reaching the stem. Stem fleshy, fragile. Veil apparently absent; no annulus. Volva present, forming a sheathing cup at the base of the stem or a margin on the bulb, or falling into powder and disappearing. Spores white.*

IMPORTANT AMERICAN LITERATURE.

Murrill: N. Am. Flora **10**: 65. 1914.
Murrill: Mycologia **5**: 81. 1913.
Beardslee: Jour. E. Mitchell Sci. Soc. **24**: 115. 1908.
Beardslee: Amanitas of the Southern Appalachians, Part I. Published by the Lloyd Library, Cincinnati, 1902.
Peck: N. Y. St. Mus. Rep. **23**: 96. 1872.
Peck: N. Y. St. Mus. Rep. **33**: 38. 1880.
Lloyd: A Compilation of the Volvæ of the U. S. Cincinnati, 1898.
Morgan: Jour. Mycology **3**: 25. 1887.

KEY TO THE SPECIES.†

1. Volva forming an ample sheath at base of stem..... 2
1. Volva breaking into rings or patches by the elongation of the basal part of the stem.....*A. strangulata* (2)
1. Volva not forming a sheath or elevated rings or patches..... 3
2. Volva a thin, long sheath collapsed against the stem; cap smooth, with or without volva patches.....*A. vaginata* (1)
2. Volva more firm, not collapsed, often broken; cap with reddish scales .....*A. agglutinata* (4)
3. Plants with a margined bulb, stem very short..... 4
3. Plants without bulb, stem longer..... 5
4. Cap with small warts, gills broad.....*A. pubescens* (6)
4. Cap nearly smooth, gills narrow.....*A. pusilla* (7)
5. Cap orange red.....*A. parcivolvata* (3)
5. Cap ashy brown or gray, covered with gray meal.....*A. farinosa* (5)
5. Cap egg yellow.....*Amanita gemmata*‡

* This genus, it seems to me, is artificial and without systematic significance. Separated from Amanita by the absence of a single character, which is also frequently absent in accepted species of that genus, the species vary among themselves more than they do from certain corresponding species of Amanita.

† Figures in parentheses refer to the plant's number.

‡ This species of Amanita is often without a veil and may then be sought here.

1. **Amanitopsis vaginata** Bull.

PLATES 2, 3 AND 62.

This species is quite remarkable for its sharp variations in color. There are three pronounced color forms—(1) white, (2) tawny or chestnut or related colors, and (3) lead brown or mouse color. These have been called varieties (var. *alba,* var. *fulva,* and var. *livida*). While intermediate colors are not so common as the extremes, they are not at all rare, and as there seems to be little if any difference (but see note under 847) between these plants except color it would seem best not to call them varieties, but only color forms. The following description will include all the forms:

Tall slender plants that are rather common in woods, groves, borders, and shaded lawns. Cap 4-10 cm. wide, usually small in proportion to the height, when mature flat or the margin elevated, or sometimes remaining campanulate; surface smooth, shining, not viscid, at times with flat patches of the white volva; margin strongly tuberculate-striate; color showing a wide range, white, tawny, chestnut, cinnamon-buff, Brussels brown, capercine orange, lead or mouse color, with intermediate shades at times. Flesh soft, fragile, thin, whitish or tinted like the cap beneath the separable cuticle when the color is strong, only about 3 mm. thick in center; tasteless and odorless.

Gills moderately close, free or just reaching the stem, sometimes slightly decurrent by a line, about 3-5 mm. wide; color in the white form white, in the reddish form nearly white to light creamy brown and deeper brown where rubbed, in the gray forms whitish to distinctly drab.

Stem up to 19 cm. long, slender, nearly even or tapering upward, 3-9 mm. thick at top; surface more or less fibrous-flocculent, about color of gills, stuffed in center; base not bulbous, but surrounded by a thin or thickish, ample, sheathing volva which is usually collapsed against it, and is smooth, not flocculent on the outside and not slimy within. In most forms the volva is white, but in the gray forms it may be distinctly smoky on the inside.

Spores white, globose, very variable in size in the same and in

different plants, but showing no correspondence with the color forms.*

Edible.

Colored illustrations: Miss Marshall, Mushrooms, plate opposite p. 54; and Mycologia 1: Plate 7. 1909.

144. Battle's Park, fall of 1908. Tawny form. Spores 9.3-10 μ.
145. Battle's Park, near Dr. Battle's house, September 21, 1908.
321. Battle's Park, September 30, 1911. Tawny form.
414. Chapel Hill, November 7, 1911. Photo. Tawny form. Spores spherical, 6.5-9 μ.
455. Across road in front of Dr. Pratt's, September 28, 1912. Pure white; spores averaging about 8.4 μ.
479. Woods back of school house, October 3, 1912. Photo.
528. Woods southeast of school house, October 8, 1912.
690. Woods at top of Lone Pine Hill, May 29, 1913. Light mouse color.
700. Woods near Battle's branch, June 20, 1913.
729. In grass in arboretum, west side. Plants deep mouse color. Spores short elliptic, 7.4-9.2 x 9.2-11 μ.
732. Deep woods about one-third way down Lone Pine Hill, September 10, 1913.
763. Woods, Battle's Park, September 14, 1913. Two plants. Cap leaden brown, gills, stem, and volva lighter, but tinted with same color as cap.
764. Grove in front of Dr. Battle's, September 14, 1913.
807. Woods east of school house, September 22, and (the long one) Battle's Park, south of cemetery, September 24, 1913. Spores very variable, 6.6-14.8 μ.
847. Battle's Park, September 25, 1913. Photo. Two large plants, one 19 cm. high; cap only about 5 cm. broad, a beautiful Brussels brown color (Ridgway). Cap campanulate, not expanding completely as it does in the gray form. Gills nearly white, turning cream and drying yellow. Most of the plants of this variety seen this fall were of this color. One seen had more red in it. Spores very variable in size, 6.6-14.8 μ.
853. In deep pine woods southeast of brickyard in Tenny's meadow, September 28, 1913. Photo. A good many plants. Cap drab gray. Spores spherical, 8.3-12 μ.

* This great variation in the spores is rather uncommon in agarics. The spore size, and particularly the shape and surface markings (if any) are a great help in most cases in determining the species, and their neglect has led to many errors that could have been avoided. It should be borne in mind, however, that spores may vary in size in the same species under different conditions. Cotton has shown (Trans. Brit. Myc. Soc. 4: 298. 1914) that if the cap of *Stropharia semiglobata* be cut from the stem the spores successively formed decrease in size from 10 x 18 μ at first to 7 x 12 μ during the eighty-third hour. This he supposes due to the artificial conditions, but it is obvious that spores might vary considerably in natural conditions if moisture or food should be reduced.

1101. At foot of a large white oak in front of Gimghoul Lodge by street, July 9, 1914. Spores 7.5-9.4 μ.
1105. By path above Meeting of the Waters, along west branch, July 9, 1914. Photo. Mouse-gray.
1131. Oak grove near spring west of Dr. Hamilton's house, July 12, 1914. Photo. Tawny.
1559. In open mixed woods south of athletic field, June 19, 1915. Color Brussels brown.
1618. Sandy soil by Emerson's pond, July 16, 1915. Color a pale fleshy buff, between light buff and ivory yellow (Ridgway).
1793. Mixed dry woods, September 15, 1915. Color exactly tawny. Spores globose, 9-12.6 μ.
1813. Growing in dry woods northeast of graded school, September 17, 1915. These two plants were nearly white, but had a slight tint of mouse color.
1814. Deep woods, Tenny's ravine, September 17, 1915. Mouse gray with a tint of rufous.
1843. In deep woods by Battle's branch, September 20, 1915. Photo. White form. Cap pure white except for creamy center, 10 cm. broad. Spores variable, spherical, 8.5-11 μ in diameter.
2064. In grove near Dr. Battle's on campus, June 11, 1916. Photo. Mouse gray.
2100. Battle's Park, near east gate of campus, June 14, 1916. Photo.
2113. In grass under "Davie Poplar," campus, U. N. C., June 16, 1916. Cap cinnamon-buff on umbo, fading to pale straw on margin.

Blowing Rock. Atkinson.
Asheville, common. Beardslee.
Flat Rock. Memminger.
Common, woods and fields. Curtis.

2. **Amanitopsis strangulata** Fr.

PLATES 4 AND 62.

Cap up to 10.5 cm. broad, convex when young, expanded and slightly depressed in center at maturity, slightly umbonate, inherently radially fibrous and often cracked toward the strongly striate and slightly tuberculate margin, more or less covered with flattish, rather firmly adherent patches of the mealy, ashy-gray volva, or without these, scarcely viscid, dull or faintly shining. The color is not so variable as in *A. vaginata*, but we have found several color forms with intermediates, one smoky brown, exactly Saccardo's umber except in center which is sepia colored (Ridgway); another steel gray on margin and mouse gray in center, or a rather light lead-gray all over, the center darkest; another is almost

white, faintly creamy to pallid white; another is almost black in center, rapidly fading to mummy brown or sepia on margin. Flesh white, smoky near the surface, about 3.5-4 mm. thick in center, very thin in marginal half, colorless and with a flat, mild taste.

Gills free, moderately close, about 5-6 mm. wide, broad and rounded at margin, pointed at stem and barely reaching it, nearly pure white to light ash color, or light drab.

Stem about 8-17 cm. long, 6-7 mm. thick at cap, tapering upward, not bulbous, whitish or lighter than the cap, smooth or lightly fibrous and with the superficial layer often cracked, not at all lined at the top; base more or less incrusted with mealy patches of the friable and flocculent, mouse-gray volva, which usually forms a partial or complete ring one or two cm. from the base, but rarely a sac or complete basal incrustation. Flesh white, delicate, with a clear hollow which is about 2 mm. in diameter.

Spores white, usually spherical, but in some plants, as in No. 2201, subspherical to short elliptic, smooth, not so variable in size as in *A. vaginata,* usually about 8-11 μ in diameter,

Edible.

The volva is very peculiar and is different from any other species of Amanitopsis or Amanita. It breaks up into patches and particles of various sizes, which when quite fresh are slimy and whitish on inner side; parts that remain sticking to the stem are usually not at the base, but 1 cm. or more above it. The behavior is most like that of the volva of *Amanita Frostiana,* but it is more flocculent than in that species. From the volva of *A. farinosa* it differs in being more flocculent and less friable, and in the slimy inner surface and greater abundance. The volva is different both in structure and behavior from that of *A. vaginata,* which in other respects is very near. The volva of *A. vaginata* is nearly always white even in the deeply colored forms (in the gray form it is sometimes smoky) and forms a persistent ample membranous cup. The cap color is not so variable as in the last and the two plants seem distinct here, though undoubtedly very closely related. The structure and behavior of the volva is the only noticeable difference except that the spores are not so variable in size in *A. strangulata* and are

sometimes elliptic. Beardslee reports it from the mountains of West Virginia (Jour. E. Mitchell Sci. Soc. 24: 124. 1908), and he writes me that it is rare at Asheville. It has not been recorded heretofore from North Carolina.

489. Near path from east gate of campus south of Dr. Battle's, October 4, 1912. Photo. Spores white, spherical, 7-11 μ.

2102. Woods near east gate of campus, June 14, 1914. Photo. Spores pure white, smooth, spherical, 7.7-12.2 μ.

2196. Woods one-quarter mile southwest of Mr. Pritchard's, June 22, 1916. Spores spherical, 8-11 μ.

2197. Woods east of old graded school building, June 22, 1916. Color very peculiar in one plant, being a rather light lead gray all over, about drab gray in center and smoke gray toward margin (Ridgway), somewhat darker in center, a color that I have not seen in any of the numerous shades exhibited by *A. vaginata*. The three other plants were almost white, a faintly creamy and rather pallid white.

2201. Sandy woods road southwest of athletic field, June 23, 1916. Photo. Center almost jet black, rapidly fading to mummy brown or sepia on margin. One plant with large white volva patch covering about one-third of its surface. This structure was softly fibrous-flocculent, about like absorbent cotton and quite thin. At base of the stem the volva was not broken up as much as usual, but remained as a torn, thin and imperfect white cup which was slimy on the inside and flocculent-fibrous on the outside, differing decidedly from the volva of *A. vaginata*, which was compared with it carefully in the fresh state. The volva of the latter (buffy-gray form) was thicker, firmer, more perfect, smooth on the outside and not slimy within. Spores subspherical to elliptic, 7.5-9.3 x 9.4-11 μ. Drawing.

2212. Dr. Wheeler's lawn, June 23, 1916. Three plants; one a light steel gray on the margin to light mouse gray in center, the other two umber gray, one with numerous small, flat patches of the volva in the central region.

2312. Oak grove at The Rocks, June, 1916.

2415. Deciduous woods near path by brook, Battle's Park, July 22, 1916. Photo.

Asheville. Beardslee.

3. Amanitopsis parcivolvata Pk.

Amanita muscaria coccinia Beardslee.

PLATES 5 AND 62.

Cap 6-8.5 cm. wide, smooth, shining, viscid, no volva particles or a few soft, more or less pyramidal warts in center; strongly

striate on margin. Center deep scarlet, shading to orange on margin, the color of *A. Cæsaria* or the brighter forms of *A. muscaria*. Flesh very thin, yellowish.

Gills free, about cream color, not crowded, about 2.5 cm. deep in center, their edges dusted with fine yellow pulverulent particles.

Stem 10-14 cm. long and about 3 mm. thick, tapering upward, stuffed inside, ending below in a moderate bulb, or bulb absent; surface dusted with the same yellow pulverulence as the gills, which is most noticeable above.

Volva of white or yellowish rings and particles on bulb or base of stem, or very little signs of the volva on the stem, most of it becoming broken off in friable scales which remain sticking to the earth around, very much as in *Amanita Frostiana*.

Spores (of No. 801) white, short elliptic, 7.4-9.2 x 9.2-11 μ.

Common in lawns, groves, and occasional in cultivated places in June, less common in fall. In wet weather the colors of the cap tend to fade considerably as in *A. muscaria* and many other species.

Edibility not known.

801. In Dr. Pratt's lawn, east side in front, September 21, 1913. Photo. Spores 6.2-7.4 x 9.7-10 μ.
1197. In woods south of cemetery, not far from the path to Meeting of the Waters, that runs by branch, July 23, 1914.
2097. Dr. Lawson's lawn, June 14, 1916.
2103. Cultivated soil, Prof. Holmes' yard, June 14, 1916.
2105. Campus near chemistry building, June 14, 1916.

Asheville, common. Beardslee.
Ridge Crest, August 7, 1913 (No. 957). Coker.
Flat Rock. Memminger.

4. **Amanitopsis agglutinata** (B. & C.) Sacc.

A. volvata (Pk.) Sacc. *Agaricus solcatus* Howe.

PLATES 6 AND 62.

Cap 2.5-8 cm. broad, expanded and slightly gibbous at maturity, the surface nearly white or quite reddish from the reddish-brown squamules or scales which are more or less abundantly present, especially in the center, the scales decreasing to fine floccose fibers

toward the margin: sometimes, particularly in rainy weather, the scales and fibers more or less disappear. Between the scales the color of the cap is white; marginal third of the cap distinctly striate, sometimes pectinate. Flesh very thin toward the margin, about 4-5 mm. thick near the stem, soft, white, or light creamy pink and a deeper pink when bruised; taste mild.

Gills not crowded, distant from the stem when mature, not forked, a few short ones, white or faintly rosy when fresh, on drying or when bruised becoming a delicate and pretty light brown or pinkish-brown color; pointed at stem, broader and rounded at margin, the short ones truncate at the inner end, about 5-6 mm. deep.

Stem 6-14 cm. long, tapering upward, 5-10 mm. thick at top, 10-18 mm. thick at base; surface covered with small brownish-red or white, flocculent scales and particles (color of cap). A distinct central cylinder is present and is stuffed with soft cotton.

Volva a large ample sac, persistent and firm, usually not collapsing against the stem, but fused with it in the lower half, the free limb about 3-5 cm. long; surface white, turning brownish, covered with a white tomentum which holds firmly to the sand in which it grows. It dehisces apically and usually leaves no trace on the cap, but in No. 71 there was a large white patch left in center of cap.

Spores elliptic, varying considerably, pure white, 5-6 x 7.4-11 μ.

Rather common in sandy soil near streams and occasionally in drier sandy woods.

The regular and fibrous-looking patches which are inherent with its surface make the plant approach the appearance of a Lepiota in texture. This is our only species in the Amanita group that has a fibrous or flocculent covering on the cap under and distinct from the volva. The latter is a firm, dense, white membrane with a smooth inner surface which usually makes a clean break across the top as in Volvaria and in some species of Amanita and Amanitopsis.

In respect to the flocculence on the cap this plant resembles *Volvaria bombycina* and *V. parvula* and the general appearance of the plant and volva is more like a Volvaria than an Amanitopsis.

It seems possible that the species is really near Volvaria and not Amanitopsis, the white spores misleading one.

This species has been considered harmful, but (as *A. volvata*) McIlvaine speaks of it as delicate and tender, without pronounced flavor, and equal to *A. vaginata*. Ford and Clark (Mycologia 6: 167. 1914) place it with the very dangerous species.

71. In Battle's Park, growing in path, October 2, 1911.

515. Woods on other side of small branch south of campus, October 4, 1912. Two photos.

1109. By path along branch above Meeting of the Waters, July 9, 1914. Spores elliptic, with lateral mucro at one end, granular, sometimes with oil drops, 3.7-5.5 x 7.4-11 μ.

1194. Above path by branch north of Meeting of the Waters, July 13, 1914.

1208. On south bank of Bowlin's Creek in sand, along Fern Walk, above Emerson's Pond, July 25, 1914. Two photos. This was a fine lot of plants varying much in size, typical of one form, which is nearly always reddish salmon in color. The spores were white, smooth, elliptic, 5.1-6.8 x 8.5-10.2 μ.

1217. In cane brake on New Hope Creek, below Durham bridge, July 27, 1914.

1554. In dry open mixed woods, south of athletic field, June 19, 1915. Photo. Spores white, smooth, elliptic, 5.4-7.2 x 9-13.5 μ. Color of cap when young white on margin, brownish in center, at maturity becoming brown all over (a buffy tan, nearly warm buff of Ridgway). Flesh soft, white when cleanly cut, but turning pinkish at the slightest bruise, tasteless.

1576. In New Hope flood plain about one mile below Durham bridge, in almost bare soil among large trees, June 26, 1915. Margin of gills flocculent, the inner ends of the short ones squarely truncate, as in *Amanita muscaria*. Spores white, elliptic, smooth, 4.4-5.5 x 7.5-11 μ.

1587. By path along Battle's branch, July 6, 1915.

1601. By path along branch north of Meeting of the Waters, July 11, 1915. Photo with Nos. 1602 and 1603.

1602. In low shaded place near branch, 300 yds. west of Meeting of the Waters, July 13, 1915. Photo with Nos. 1601 and 1603.

1603. Growing in shaded place near Battle's branch, July 12, 1915. Photo with Nos. 1601 and 1602.

1629. Damp sandy soil by Battle's branch, July 22, 1915. Photo. Spores white, elliptic, smooth, 5.4 x 9 μ.

1861. Sandy soil, oak woods, Battle's Park and Rocky Ridge Farm, September 20 and 22, 1914. Spores elliptic, smooth, one oil drop, 5-6.3 x 9-12.6 μ.

2330. Damp rather sandy soil along Meeting of the Waters branches, June 30, 1916.

Asheville, common. Beardslee.

Flat Rock. Memminger.

Low district, pine woods. Curtis.

5. **Amanitopsis farinosa** (Schw.) Atk.

PLATES 7 AND 63.

A rather rare plant growing solitary in cool woods or open groves from June to fall. Cap about 2.5-5 cm. broad, ash-gray or mouse-gray to pinkish-straw color from the more or less extensive remains of the friable, mealy volva that covers it; margin striate with lighter lines. Flesh white, thin, 1-2 mm. thick at center, tasteless and odorless.

Gills white or nearly so, free, slightly crowded, 2-4 mm. wide.

Stem white or lighter than cap, sparingly or plentifully covered with white mealy particles, slightly enlarged at the base, but not bulbous, and not rooting, but abruptly rounded (nearly truncate) below as a rule, the very base ash or straw color from the mealy particles of the volva, or in some cases absolutely devoid of any sign of volva particles when mature; flesh solid, but soft inside.

Spores white, smooth, globose, a large mucro, variable in size, 4.4-7.6 μ.

Edibility not known.

Colored illustration: Mycologia 4: Plate 56. 1912.

69. Chapel Hill, October 23, 1911.
2069. In grove in front of Gimghoul Lodge, June 10, 1916. Sphores spherical, 5.5-7.4 μ.
2088. Grove in front of Gimghoul Lodge, June 13, 1916. Photo.
2136. Battle's Grove, June 15, 1915. Spores spherical, 4.4-6.3 μ.

Blowing Rock. Atkinson.
Asheville, common. Beardslee.
Montreat, rocky woods, July 6, 1915. Coker. Photo. Spores spherical, a large mucro, 5.5-7.6 μ.
Flat Rock. Memminger.
Middle district, woods (Schw.). Curtis.

6. **Amanitopsis pubescens** (Schw.)

PLATES 8, 9 AND 63.

A neat, sharply marked and very attractive plant growing in dry sandy soil in open groves. Cap from 2.3-6.4 cm. broad, depressed in center, the margin rounded and moderately striate; surface very light brown, near Ridgway's maize yellow, but lighter; adorned

with small, flattish, soft warts of the same color which are firmly adherent. Flesh nearly white, not changing when bruised, 3-4 mm. thick at stem, quickly thinning to a membrane on marginal third; no taste or odor.

Gills rather crowded, color of cap, of peculiar form, shaped like a tear drop, sharply pointed toward the stem, which they just touch, wide and rounded at the margin where they hang some distance below the cap. Their edges are covered with the fine flocculence often seen in other species of Amanitopsis.

Stem short and small for the size of the plant, from 1-2.5 cm. long above ground, 4.5-8 mm. thick in center and usually tapering downward to a short abrupt bulb which is usually more than half sunken in the ground; surface very pale ash gray (nearly white), pulverulent all over above the bulb, but not viscid as in *Amanita muscaria*. Flesh solid and firm with a central cylinder of white, rather firm stuffing. Bulb margined by the conspicuous but low, irregular rim of the volva, which is firm and covered on the outside with fibrous flocculence. Beneath the ground the bulb is covered with sand, which is held by the fine flocculence. A veil in all cases is entirely lacking.

Spores white, elliptic, 5-7.2 x 9-14.4 μ.

A remarkably distinct plant, quite different from any other species of Amanitopsis or Amanita. It is decidedly attractive and constant in its appearance and is rather firm, not quickly decaying. Its affinities are problematical, but it seems nearest *Amanita muscaria*. From *A. pusilla* Pk. (a doubtful species) it is easily separated by the broad gills, flocculent cap and much larger spores.

Edibility not known.

That this is Schweinitz's species I have no doubt. It has not been seen since he collected it at Salem, ninety-five years ago.

739. Very sandy, poor soil in path below athletic field to Meeting of the Waters, September 12, 1913. Photo. Spores white, elliptic, 5.5-6.6 x 8.5-11 μ.

767. Sandy dry walk in grass in grove near northeast gate of arboretum September 14, 1913. Spores elliptic, smooth, 5.7-2 x 9-14.4 μ.

1714. Growing in sandy soil in woods road, across branch south of athletic field, September 9, 1915. Spores elliptic, smooth, one large oil drop, 5.1-7.2 x 9-10 μ.

1756. Sandy soil by sidewalk in front of Dr. Wagstaff's. Spores elliptic, smooth, one large oil drop, 5.5-7.2 x 9-10 μ.

7. **Amanitopsis pusilla** Pk.

This little plant is very imperfectly known. It has been found but once and the type collection is in a very fragmentary condition. I have not been able to see the type so far, and venture no opinion on the validity of the species. For convenience of students I give below the original description by Peck (Rep. N. Y. St. Mus. **50**: 96. 1897):

"Pileus thin, broadly convex or nearly plane, subglabrous, slightly umbonate, even on the margin, pale brown; lamellæ narrow, thin, close, free, becoming brownish; stem short, hollow, bulbous, the bulb margined by the remains of the membranous volva: spores broadly elliptical, .0002 to .00024 in. long, .00016 broad [5-6 x 4 μ]. Pileus about 1 in. broad; stem 8-12 lines long, 1-2 lines thick. Grassy ground. Gouverneur, St. Lawrence County [New York]. September."

AMANITA

Usually solitary. Cap fleshy; surface glabrous or with warts, flat patches or mealy patches from the volva. Gills free or just touching the stem. Stem central, fleshy. Veil present,* forming an annulus or falling off in friable pieces, or torn into fragments which stick to the gills or margin. Volva present, forming a distinct sheathing cup or ridges and warts at the base of the stem, or fragile and friable and almost or entirely disappearing. Spores white usually, sometimes olive or cream color.

IMPORTANT AMERICAN LITERATURE.

NOTICE

For *Amanita nitida* Fr. see Addendum, page 87.

bulb, odor of chlorine.....*A. virosa* (2b)

1. Volva not as above, or if nearly so, no odor of chlorine..... 8
2. Volva fused with the stem only at the very base; cap margin distinctly striate; stem with a distinct central cylinder that is lightly stuffed or hollow..... 3
2. Volva fused with the stem for 1 cm. or more, cap not striate or faintly so 6
3. Cap red or orange.....*A. Cæsaria* (1)
3. Cap not red or orange..... 4
4. Veil smoky, base bulbous, spores spherical.....*A. porphyria* (4)
4. Veil whitish or smoky, base not bulbous, spores elliptic..... 5
5. Gills 7-10 mm. wide, cap white to pallid pinkish-tan.....*A. recutita* (3)
5. Gills 4-6 mm. wide, cap more than 5 cm. broad, usually large .....*A. spreta* (2)
5. Gills 2-3 mm. wide, cap 2-3.5 cm. broad.....*A. spreta* var. *parva* (2a)

* The veil is frequently absent in *A. gemmata* and rarely so in abnormal plants of *A. muscaria.*

† Figures in parentheses refer to the plant's number.

1714. Growing in sandy soil in woods road, across branch south of athletic field, September 9, 1915. Spores elliptic, smooth, one large oil drop, 5.1-7.2 x 9-10 μ.

1756. Sandy soil by sidewalk in front of Dr. Wagstaff's. Spores elliptic, smooth, one large oil drop, 5.5-7.2 x 9-10 μ.

7. Amanitopsis pusilla Pk.

This little plant is very imperfectly known. It has been found but once and the type collection is in a very fragmentary condition. I have not been able to see the type so far, and venture no opinion on the validity of the species. For convenience of students I give below the original description by Peck (Rep. N. Y. St. Mus. **50**: 96.

AMANITA

Usually solitary. Cap fleshy; surface glabrous or with warts, flat patches or mealy patches from the volva. Gills free or just touching the stem. Stem central, fleshy. Veil present,* forming an annulus or falling off in friable pieces, or torn into fragments which stick to the gills or margin. Volva present, forming a distinct sheathing cup or ridges and warts at the base of the stem, or fragile and friable and almost or entirely disappearing. Spores white usually, sometimes olive or cream color.

IMPORTANT AMERICAN LITERATURE.

Murrill: N. Am. Flora **10**: 68. 1914.
Murrill: Mycologia **5**: 72. 1913.
Peck: N. Y. St. Mus. Rep. **23**: 96. 1872.
Peck: N. Y. St. Mus. Rep. **33**: 38. 1880.
Beardslee: Jour. E. Mitchell Sci. Soc. **24**: 115. 1908.
Beardslee: Mycologia **6**: 88. 1914.
Lloyd: A Compilation of the Volvæ of the U. S. Cincinnati, 1898.
Morgan: Jour. Mycology **3**: 25. 1887.

KEY TO THE SPECIES.†

1. Volva forming a distinct ample sheath with a free margin around the base of the stem, no odor of chlorine 2
1. Volva forming a distinct but narrow free ring at the top of an oval bulb, odor of chlorine ..... *A. virosa* (25)
1. Volva not as above, or if nearly so, no odor of chlorine 8
2. Volva fused with the stem only at the very base; cap margin distinctly striate; stem with a distinct central cylinder that is lightly stuffed or hollow 3
2. Volva fused with the stem for 1 cm. or more, cap not striate or faintly so 6
3. Cap red or orange ..... *A. Cæsaria* (1)
3. Cap not red or orange 4
4. Veil smoky, base bulbous, spores spherical ..... *A. porphyria* (4)
4. Veil whitish or smoky, base not bulbous, spores elliptic 5
5. Gills 7-10 mm. wide, cap white to pallid pinkish-tan ..... *A. recutita* (3)
5. Gills 4-6 mm. wide, cap more than 5 cm. broad, usually large ..... *A. spreta* (2)
5. Gills 2-3 mm. wide, cap 2-3.5 cm. broad ..... *A. spreta* var. *parva* (2*a*)

* The veil is frequently absent in *A. gemmata* and rarely so in abnormal plants of *A. muscaria*.

† Figures in parentheses refer to the plant's number.

6. Veil attached at very top of stem, flocculent beneath; spores elliptic.....*A. magnivelaris* (8)
6. Veil not attached at very top of stem, not flocculent beneath..... 7
7. Gills becoming flesh color; spores elliptic.....*A. hygroscopica* (7)
7. Gills not becoming flesh color; spores spherical or rarely elliptic.....*A. verna* (6)
8. Cap red, orange, salmon, or yellow, not brownish..... 9
8. Cap brownish red or brownish yellow or pallid brown or ashy brown or umber brown..... #12
8. Cap white, creamy, tan, pallid buff or drab..... #16
8. Cap greenish, or blackish brown, or smoky brown..... 24
9. Cap strongly tuberculate-striate, egg yellow, veil white..*A. gemmata* (11)
9. Cap when fresh not striate or slightly so..... 10
10. No smell of chlorine..... 11
10. Smell of chlorine, color light reddish or salmon.....*A. chlorinosma* (form) (24*b*)
11. Cap orange yellow or salmon, volva patches not orange..*A. muscaria* (13)
11. Cap orange yellow, volva patches orange.....*A. Frostiana* (20)
11. Cap and veil primrose yellow, volva lavender.....*A. mappa* (var.) (10)
12. Plant with smell of chlorine..... 13
12. Plant without smell of chlorine..... 14
13. Cap covered with ashy-brown warts.....*A. Atkinsoniana* (26)
13. Cap without warts, center covered with a friable, umber meal .....*A. cinereconia* (27)
14. Warts yellow, cap yellow-brown or buffy-vinaceous..*A. flavorubescens* (19)
14. Warts brownish, cap variable, mostly brownish red, flesh changing to red.....*A. rubescens* (17)
14. Warts none or gray or brownish gray; flesh not changing..... 15
15. Stem hollow or lightly stuffed; spores elliptic.....*A. spissa* (14)
15. Stem solid; spores spherical.....*A. mappa (A. lignophila)* (9)
16. A strong smell of chlorine..... 17
16. No smell of chlorine..... 18
17. Cap, veil, and stem covered wholly or in part with friable meal.....*A. chlorinosma* (24)
17. No friable meal; cap and bulb usually strongly warty.....*A. strobiliformis* (23)
18. Veil absent or very ephemeral; stem strongly glutinous.....*A. muscaria* (depauperate form) (13*a*)
18. Veil simple, thin; stem not glutinous..... 19
18. Veil compound, attached to stem by strong fibers..... 23
19. Plants rather small, or of medium size, a distinct volval roll or truncated bulb at base of stem..... 20
19. Plants large or medium, base of stem not as above..... 21
20. Cap distinctly tuberculate-striate; spores elliptic.....*A. cothurnata* (12)
20. Cap not striate or lightly so; spores spherical.....*A. mappa* (*A. floccocephala*) (9)

21. Center of cap smoky tan or smoky straw.....*A. excelsa* (16)
21. Cap white all over, warts, if present, brownish..... 22
22. Gills narrow, flesh reddish when bruised.....*A. rubescens* var. *alba* (18)
22. Gills broad, flesh not reddish when bruised.....*A. spissa* var. *alba* (15)
23. Bulb abrupt, smooth, large.....*A. abrupta* (22)
23. Bulb not abrupt, warty.....*A. solitaria* (21)
24. Cap greenish, a smell of chlorine.....*A. chlorinosma* (form) (24a)
24. Cap smoky-black or smoky-brown in center.....*A. phalloides* (5)

1. **Amanita Cæsaria** Scop.

A. pellucidula Banning and Pk.

PLATES 10, 11 AND 63.

A large and conspicuous plant that is common in deciduous and mixed woods in summer, and occasional in fall. Cap expanded at maturity, smooth, up to 30 cm. wide, oval when young, shining, occasionally with a flat patch of the volva in the center, margin strongly striate at all ages, color yellow at the edge, shading through orange to deep red or orange-red.

Gills not crowded, free from the stem, a light but distinct yellow.

Stem up to 14 cm. long, slightly tapering upward, not bulbous, distinctly hollow, with a light pith when young; surface yellow, smooth and shining.

Veil light yellow, membranous, compound, *i. e.*, attached over several centimeters of the stem, remaining as a skirt about 1 to 2 cm. from the top.

Volva very large, white, thick and leathery, persisting as a large sheathing cup, which stands free from the stem and is attached at its very base.

Spores elliptic, white, averaging about 6.6 x 11 μ.

Colored illustration: Atkinson, Mushrooms, Plate 19, Fig. 1.

Very small depauperate plants are occasionally found, and in these cases the colors are less bright, as noted by Atkinson (Mushrooms, etc., p. 70). In our collections 544 and 1202 the plants were of this character. In 544 the cap was yellowish chestnut-brown, gills light yellow, stem and veil white.

Amanita Cæsaria is edible and in Europe is highly esteemed. I have eaten it, but did not think it particularly good.

450*a*. Chapel Hill, September 28, 1912. Spores 5.1-6.3 x 7.4-8.2 μ. (Plant lost.)
461. Battle's Park, September 30, 1912. Photo.
488. Woods southeast of school house, October 3, 1912.
505. Woods east of school house, October 5, 1912. Photo.
527. Woods south of campus, October 8, 1912. Photo.
544. Woods near path in Battle's Park, near crossing beyond Lover's Leap, October 10, 1912. A depauperate form.
650. Woods east of school house, October 10, 1912.
701. Woods south of Dr. Battle's house, June 20, 1913.
815. Woods back of Dr. Pratt's and in woods across the road from Dr. Pratt's, September 16, 1913.
1115. By path above Meeting of the Waters, July 9, 1914.
1120. Battle's Park, behind Mrs. Gore's, July 10, 1914. Photo.
1202. Near Battle's branch, July 24, 1914. Photo. This little plant was typical *A. Cæsaria* except for its very small size and dull yellow cap—not scarlet in center.
1614. In dry soil near pines near top of hill at "Fern Banks," July 16, 1915. Photo.

Blowing rock, Atkinson, also the depauperate form.
Asheville, very common. Beardslee.
Balsam, Jackson County (No. 1642). Sent us by Miss Totten.
Flat Rock. Memminger.
Common in oak forests. Curtis.

2. **Amanita spreta** Pk.

A. cinerea Bres.

PLATES 12 AND 63.

Cap up to 14 cm. broad, almost plane at maturity, naked or with a few fragments of the volva, which, when present, are leathery pieces and not warts; surface viscid, and with a separable cuticle, smoky brownish gray (Saccardo's umber—Ridgway), or varying rarely to nearly white; margin moderately or rather strongly striate Flesh white, soft, tasteless and odorless.

Gills crowded, the long ones pointed at the inner end and just reaching the stem, rounded and deepest near the outer end where they are 5-6 mm. wide, white, changing to sordid, many short ones with rather truncated inner ends.

Veil flocculent-fibrous below (not mealy granular), smooth above, delicate and rather fragile, often torn and perforated, usually separating entire and hanging from about 1 to 1.5 cm. from the top; collapsing completely against the stem in age and fading to a thin coating which, in Chapel Hill plants, is typically a light smoky color, but varies in this respect, at times being decidedly sooty, at others merely brownish with a faint smoky tint. There is no reference to a smoky tint in descriptions of the more northern form.

Stem large, up to 13 cm. long, tapering upward, about 10 to 14 mm. thick at top, nearly white or cinereous gray, especially below the veil, where it is flocculent-fibrous from the threads of the veil that connect with it when expanding. There is a large and quite distinct central cavity in the stem which is generally very loosely stuffed with a delicate cotton, which may be more or less dried up, and which collapses on exposure. There is no bulb. After examining many specimens I find that the stem is usually smoky gray when old, from the surface membrane of that color, which usually becomes broken up into scales and squamulose areas, especially above the veil. The veil usually partakes of this smoky change and it may be darker or lighter than the surface of the stem.

Volva rather thick and leathery, as in *A. virosa,* but becoming thinner in age, attached at the very base or very near the base of the stem, breaking irregularly into lacerations or large flaps which may be as long as 3 cm., or may be shorter and more broken with parts remaining on cap as thick, flat patches.

Spores white, elliptic, averaging about 7.4 x 11 μ, but varying greatly in size in different plants and at times in the same plant. Difference in habitat does not seem to be associated with any difference in the spores.

This species differs from *A. verna* and from *A. phalloides* in its hollow stem, color of cap, striate margin, more delicate veil, which is flocculent all over below and which usually changes to a smoky color (veil of *A. verna* and *A. phalloides* is smooth below, particularly on the marginal half), in the absence of a bulb, in attachment of gills by a tooth, in thicker volva which is usually less amply pre-

served, and in the elliptical spores. The color is much less variable than in *A. phalloides,* and there is a difference in tint, *A. spreta* being Saccardo's umber, while *A. phalloides* is more of a smoky color.

On September 14, 1913, I found in Battle's Park eleven plants of *A. spreta* within about 14 feet of each other. All of the caps had been broken and eaten by some animal, probably a land tortoise, as there was no sign of pieces being carried away and nibbled by squirrels. I also find that both *A. spreta* and *A. phalloides* are to some extent attacked by grubs. *A. verna,* on the other hand, seems to be always free from them.

This is one of our commonest species in Chapel Hill and it is less exacting in its habitat than any of our other Amanitas. It is often cespitose in clumps or strongly gregarious and is found in pine woods, oak woods, bushes, lawns, and bare clay, in damp, low, densely shaded places, and in quite dry, sandy open places. It is probably most common near the bushy borders of fields.

Ford has found both a hemolysin and a toxin in *A. spreta,* though in small amounts, and he classes it among the deadly species (Jour. Phar. and Exp. Ther. 1: 281. 1909). However, in later experiments Ford states that he found that the heated extract, while poisonous to guinea pigs, was harmless to rabbits (Jour. Phar. and Exp. Ther. 1: 292. 1910). There do not seem to be any recorded tests of its effects on humans, although it is usually regarded as probably poisonous. From Mrs. I. M. Jervey, of Arden, however, I learn that she has established the reputation of this species as one of the best for making soup. From notes and drawings she has sent me there can be no doubt that this is the species she and her friends eat. She says that it should be run through a meat chopper, stewed slowly with water in a double boiler for three hours, then pepper, salt and milk added. She says (in a letter of January 30, 1917): "No one has ever been made the least sick by eating this soup, and it is delicious." However, the warning cannot be too often repeated that no one should eat this or any of the Amanitas on faith from descriptions alone, and even when convinced that the species is known and harmless, it should be accepted as edible only

after careful experiments with small quantities. This is especially true of species like *A. spreta*, which have been found to contain more or less poison.

A. porphyria is said to have a sooty black ring, and in this respect our form of *A. spreta* approaches it with its smoky veil, but the former species has spherical spores, is bulbous, and is not striate on the margin. It has not yet been found in North Carolina.

424. In low leafy place close to Battle's branch, below blue bench, September 21, 1912. Photo.
428. Near branch back of Dr. Wilson's, September 22, 1912.
439. Woods southeast of athletic field, September 26, 1912. Spores averaging about 7.3 x 11 μ, but varying greatly in the same plant, some 6.6 x 10 μ, a few very large, 10-15.2 μ.
487. Scattered in woods, Battle's Park, October 5, 1912. Photo. Spores 5.9-6.7 x 10-12.2 μ.
512. Woods east of school house, October 5, 1912.
520. Woods east of school house, south of campus, October 7, 1912.
734. Woods at top of Lone Pine Hill, September 10, 1913. Photo. Spores 7-8.2 x 10-11.8 μ.
1664. Under hornbeam near spring in arboretum, July 28, 1915. Photo. A large group of fine plants. Spores white, short elliptic, smooth, 5.1-6 x 7.5-10 μ. These spores are somewhat smaller than in other collections, but the plants were otherwise identical.
2108. Roadside at "The Rocks." and in the old Mangum yard, June 14, 1916.

Blowing Rock. Atkinson.
Asheville, very common. Beardslee.
Flat Rock. Memminger.

There is little doubt that Curtis included this in *A. recutita*, which he says is common in woods.

2*a*. **Amanita spreta** var. **parva** Beardslee.

Venenarius virginianus Murrill.

PLATE 63.

This is an extreme little form of *A. spreta* and is a small plant with a very pale cap, and veil not smoky. Cap 3.5 cm. broad, pale buff in center, fading to nearly white on margin which is strongly striate. Gills attached, about 3 mm. deep, white. Stem 13 cm. long, 6 mm. thick, nearly white, finely fibrous below the veil,

minutely granular above; a distinct central cylinder that is lightly stuffed. Veil a small collapsed ring 2 cm. from the cap, white. Volva long, narrow, attached to the very base of the stem, which is not at all bulbous. Spores elliptic, 6.7-8.2 x 10-12.6 μ.

Murrill's *Venenarius virginianus,* found in the Virginia mountains, is the same as this. In the type plants of the latter the stem is quite hollow and the spores identical with ours. I find them to be 7.5-10.5 x 11-13 μ. The cap is described as "fuliginous." (N. Am. Flora 10: 71. 1914.) Beardslee's description is as follows (Jour. E. Mitchell Sci. Soc. 24: 118. 1908):

"Pileus 0.5-1 inch broad, thin and membranous, soon plane or depressed, deeply sulcate-striate on the margin. Stipe slender, white, with a distant, almost median annulus. Spores as in the type. It may be readily known by its small size."

1624. In moldy earth in oak grove west of "The Rocks," July 21, 1915. Asheville, on dry hillsides. Beardslee.

3. **Amanita recutita** Fr.

PLATES 13 AND 63.

The following is the description of the Chapel Hill plant. For the coastal plane form with lighter cap and less fragile volva see below under the Hartsville collection.

Cap 4-8.5 cm., usually about 6 cm., broad, flat or depressed in center, quite viscid when wet, naked or with a few soft, white patches of the volva in center, a thin separable cuticle, the margin distinctly striate for about 1 cm.; color a light pallid tan with a shade of smoky-pink, fading to nearly white on the margin. Flesh very thin toward margin, 5 mm. thick at center, white, soft, tasteless and odorless when fresh.

Gills distinctly but lightly attached, pure white, moderately close, somewhat veined at the cap, quite broad, ventricose, 1 cm. wide in middle, rounded at the outer edge and hanging far below the cap margin, the short ones truncate at the inner end. Where the stem is colored like the cap the margin of the gills is apt to partake of this color.

Stem nearly equal, distinctly marked above by lines from the

gills, smooth or lightly fibrous below, white or color of the cap above. In the center is a distinct central cylinder with a very light stuffing which collapses when exposed.

Veil thin, lightly flocculent below, collapsing against the stem to form a ring about 2.5-3 cm. from the cap, which makes it nearly median at times, nearly white or colored like the cap.

Volva very soft, thick, fragile, nearly white, attached near the base, but closely sheathing the stem and breaking circumcissilly, leaving a flat top with a marginal rim which is more or less broken or irregular. So fragile is the volva that separated fragments remain sticking to the soil in all cases, so that a complete cup is not preserved.

The stem is not at all bulbous in itself, but the thick, soft volva makes it seem so, especially when young; when collected or when old the substance of the volva shrinks much and is less thick. As the stem is well inserted in the ground, the volva rim is usually at or below the surface.

Spores (of No. 1684) elliptic, smooth, 5.2-7.4 x 8.5-11.5 μ.

Edibility not known (but see under *A. spreta*).

It does not seem possible to refer this to anything but *A. recutita*, but I confess to some doubt in regard to it. Fries' description agrees rather well with our plants, except that he speaks of the surface as dry and the margin as rather smooth. Curtis lists *A. recutita* as common in woods, and there is in his herbarium a poorly preserved plant with this label from Society Hill, South Carolina (near Hartsville), the spores of which agree with our plants. I find them to be, in his plant, 6.6-7.4 x 11-12 μ. He doubtless also included under *A. recutita* the form we now refer to *A. spreta*.

In his list of Blowing Rock fungi (Jour. E. Mitchell Sci. Soc. 9: 98. 1892) Atkinson lists *A. recutita* (determined by Morgan). I have seen the plant on which this determination was based, but could get no spores from it, and could not be sure of the pressed specimen.

The species differs from *A. spreta*, which is nearest, in smaller size, much wider gills, distinctly more fragile volva, and lighter color of the cap and veil. The veil may be nearly white or color of

cap, but is not smoky as in *A. spreta* (at Chapel Hill) and *A. porphyria*. A typical fresh plant of *A. spreta*, compared with the above when the description was written, clearly showed these distinctions. Its gills were only 6 mm. wide at best; and the volva tough and persistent; the veil smoky. For further notes and comparisons see under *A. spreta*.

1684. In scattered groups, poor clay soil by path from arboretum to Dr. Battle's, open places, in bare soil and in grass, September 6, 1915. Photo.

Blowing Rock. Atkinson.

Common in woods [probably meaning *A. spreta*]. Curtis.

Hartsville, S. C., July 16, 1916. Sandy soil in a thick grove of second-growth long-leaf pines.

The plants were numerous and resembled closely the Chapel Hill form described above except that the cap was lighter and the volva was not so fragile. The description follows:

Cap 2.5-7.5 cm. broad, convex then nearly plane, the center often depressed, margin strongly striate for a variable distance; color nearly white, the center straw color, moderately viscid, smooth, with or without a few thin, flat patches of the white volva. Flesh pure white, soft, not very fragile, about 5 mm. thick near stem. Odor in old age peculiar, much like that of rotting cow peas.

Gills not crowded, many short and these truncate at the inner end, distinctly but narrowly attached and usually decurrent by a line, about 8.5 mm. wide in large plants, white when young, a light straw color when mature.

Stem 7-14 cm. long, 7-12 mm. thick in center, tapering upward, but suddenly enlarged at the cap; surface white, nearly smooth or slightly silvered below the veil, a distinct central cylinder which is stuffed with delicate cotton, not bulbous, but deeply seated in an ample, membranous, white volva which is attached for only about 0.5-1 cm. at base, and usually stands free and open.

Veil delicate, thin, not friable, membranous, collapsing as a delicate white ring about 1.3-2.5 cm. from the cap.

Spores white, elliptic, smooth, 5.5-7.7 x 10.3-14.8 μ.

It is of interest to note that Fries reports *A. recutita* as occurring in pine woods.

4. **Amanita porphyria** Fr.

PLATE 63.

This species has not yet been found in the South, and I append the description given by Murrill in N. Am. Flora **10**: 70. 1914.

"Pileus campanulate to expanded, solitary, 4-5 cm. broad; sur-

face moist, subglabrous, subfuscous, varying to livid purple or brown, smooth on the margin; lamellæ adnexed, white; spores glabrous, smooth, hyaline, 8-10 μ; stipe stuffed or hollow, bulbous at the base, glabrous, whitish or subconcolorous, 6-8 cm. long; annulus membranous, persistent, superior, becoming sooty black; volva free, whitish or subfuscous, adnate to the base of the large, rounded bulb, conspicuous, lobed, thick and fleshy, persistent. In pine woods."

I have examined spores of a plant from Sweden collected by Romell (Herb. N. Y. Bot. Garden), and find them globose with a small apiculus, 6.6-8.2 μ. Beardslee gives the spores as 10-12 μ in diameter. The sooty veil is often spoken of as characteristic of *A. porphyria*, but it will be noted that in Chapel Hill the veil of *A. spreta* is also sooty.

Ford has found *A. porphyria* from Massachusetts to contain a small amount of a heat resistant poison which he thinks similar to that in *A. phalloides* (Jour. Phar and Exp. Ther. 1: 283. 1909).

5. **Amanita phalloides** Fr.

PLATES 14 AND 63.

This is a common species in Europe and the northern United States, but in this latitude it is rare and tends to be dwarfed in size and modified in structure. *Amanita verna*, regarded by many as only a form of this species, is with us entirely distinct and very abundant. Though the typical form of *A. phalloides* in Europe and the Northern States has usually a conspicuous volval cup at base, there is also in the North a form like ours where the cup is absent, the flattish bulb having only a low ridge or simply a line representing the attachment of the universal veil (Peck, N. Y. St. Mus. Rep. 33: 43. 1880). Our larger and more typical form is very rare and is found in rich mold in mixed woods. It may be described as follows:

Cap expanded, gibbous, the margin sometimes elevated, 6-9.3 cm. wide, scarcely viscid, smooth, without conspicuous inherent fibers, with or without a few flat, white, mealy volva patches; margin not striate or with a few faint lines when fully mature; color variable,

usually smoky black or smoky brown in center, sometimes Brussels brown (Ridgway), varying to much lighter brownish straw (nearly pallid white), the margin smoky-tan in the darker form to straw color or pallid white in the lighter. The plants are never the clear white of *A. verna*. We also have a small form (No. 2314) in which the cap is buffy yellow with a tint of green. When bruised the surface of both cap and stem is very apt to turn a decided brownish red in all forms, exactly as in *A. rubescens*, and the bulb and grub channels of the stem are nearly always reddish.

Gills pure white, free, but connected by a line with the stem, rather crowded, narrow, only 6 mm. wide in middle.

Veil thin, white, not very fragile, breaking from the cap margin and hanging like a skirt about 2-3 cm. from the top of the stem. It is just like the veil of *A. verna* in appearance and behavior.

Stem up to 16 cm. long and 1.3 cm. thick in center, usually tapering slightly upward, sometimes nearly equal, ending below in a distinct, usually flattish bulb that is buried in the ground; surface smooth, shining, white. Flesh firm on the surface, softer inside with fibrous material, but not hollow in our plants, and without a clear cut central cylinder as in *A. spreta;* bulb usually flattish on top and with a marginal line, or with slight, thick, marginal elevations, a volval cup being absent. Brick-colored stains are not unusual on stem or bulb where they have been rubbed.

Spores (in No. 796) white, globose, smooth, 5.9-7.7 x 6.6-8 μ in diameter; in No. 174 they are 8-9 μ.

Deadly poisonous, containing Amanita-hæmolysin and Amanitatoxin, and with no known antidote. See Ford and Brush (Jour. Phar. and Exp. Ther. 6: 195. 1914; and other papers there referred to).

Colored illustrations: Murrill, Mycologia 8, No. 5, Plate 190, Fig. 5. 1916. Murrill, Mycologia 5, Plate 87, Fig. 1. 1913. Gibson, "Our Edible Toadstools and Mushrooms," Frontispiece.

It is very important to remember that the change of color to reddish is like the change in *A. rubescens*, an edible species with a very similar bulb, and to let that species alone except in the plainest cases.

174. Mixed woods near Dr. Battle's, September 14, 1910.

301. Battle's Park, September 27, 1911. One plant. Bulb abrupt, volva represented only by a thick margin to the bulb. Cap not striate, smoky gray or brownish. Spores globose, varying considerably in size, 8.3-10 μ in diameter.

542. Woods near branch back of Dr. McKie's, October 10, 1912. Photo. Cap deep smoky brown, almost black in center, margin smooth, bulb with slight marginal elevations. Spores globose, about 8 μ in diameter.

796. Near Battle's Brook, September 19, 1913. Spores 5.9-7.7 x 6.6-8 μ.

812. Near first bridge on Battle's Brook, September 21, 1913.

1450. Thick woods by branch on path from graded school to campus. October 26, 1914.

2254. Mixed woods north of cemetery, June 26, 1916. Cap up to 9.5 cm. wide, very pale brownish tan with stains of brick where bruised. Bulb abrupt, large, cracked, scarcely margined, stained with brick as was also the solid stem. Spores spherical, 7.4-8.5 μ.

2294. Under alders by Battle's branch at first bridge, June 28, 1916. Spores spherical, 7.4-10.7 μ. Plants appear in this spot every year.

Asheville, rare. Beardslee.

Blowing Rock. Atkinson.

Flat Rock. Memminger.

Common in woods. Curtis.

5*a*. **Amanita phalloides.** Depauperate Form.

There is with us a small, pallid, slender form, that may be described as follows: Cap from 3.3-5.7 cm. wide, strongly gibbous, quite smooth and rarely with any volva patches, color pallid tan with sordid brown or reddish stains. Stem 5.6-11 cm. long, 3-4 mm. thick, nearly equal, faintly fibrous, color and stains of cap, a small bulb entirely hidden in the earth, with an obsolescent ridge at top or with a few short thick projections on the margin; flesh solid. Gills white, crowded, narrow, just reaching the stem, 2.5 mm. wide in center. Spores white, spherical, smooth, 7-10 μ in diameter in No. 1788; 7.2-9 μ in No. 1816. This form grades into such forms as No. 2254 above.

1788. Small pallid slender form. Growing in mixed woods across road 1/8 mile southwest of graded school, September 15, 1915. Photo.

1816. Two plants. In damp woods by Howell's branch, September 17, 1915. Small pallid form.

6. **Amanita verna** Bull.

PLATES 15 AND 64.

A common plant of good size, growing solitary or in groups of two or three in deciduous woods in late summer and fall. Cap pure white or the center cream colored, expanded, entirely smooth or with one or more flat patches of the volva, shining, viscid when damp, the margin quite even or very slightly striate. In the fresh young pileus the margin is at times adorned with a narrow, delicate, lace-edged rim from which the veil was ripped.

Gills rather crowded, many short, just reaching the stem, white and remaining so in age.

Veil thin but persistent, not tomentose or flocculent below, remaining attached to the stem as an ample skirt about 1 to 1.5 cm. from the cap. Later it collapses against the stem and often in damp weather absorbs moisture and becomes reduced to a yellowish slime.

Stem long and rather slender, white, smooth or with scales and lacerations, never friable and flocculent, more slender than in *A. virosa*, solid or hollow toward the top; no central cylinder (but see note under 913), ending below in a buried bulb which is generally obvious, but varies much in size.

Volva ample, white, dehiscing apically and remaining as a more or less perfect cup, which is thin and papery usually and collapses against the stem. Sometimes it is more leathery and approaching the texture of the volva of *A. magnivelaris*.

When withering the plant often becomes water-soaked, beginning at the margin of the pileus.

Spores pure white, smooth and spherical or short elliptic, varying a good deal in size in the same plant. They vary from 7.5-11 μ in diameter and average about 8-9 μ.

Deadly poisonous.

Peck gives the spore shape as the most marked distinction between *A. verna* and *A. magnivelaris*, and so does Atkinson for *A. elliptosperma*. In *A. verna* they should be spherical or nearly so, and in the two last elliptic. This distinction has usually held in my experience, but in Chapel Hill one meets with many plants of *A.*

verna in which the spores are elliptic. In plant No. 420 the spores were about 7.4 x 10 μ, although the plant was as pretty and perfect a specimen of *A. verna* as any one could wish, with the veil about 1.5 cm. from the cap, a glabrous stem and a thin collapsed volva. In a good plant of *A. verna* brought in on October 14th the spores were about 7.4-8 x 9 μ on an average, but some were perfectly spherical. A plant tested on October 15th had spores spherical, about 8 μ in diameter; in another plant they were also spherical and 6.5-8.3 μ in diameter.

For differences between *A. verna* and *A. magnivelaris* see under the latter species.

154, 155, 156, 157, 158, 163, 310, 329 were collected in every direction during October, 1911.

420. Low woods south of Dr. Wheeler's, September 20, 1912. Spores elliptic, 6.6-8.5 x 9.7-11 μ.

433. Battle's Park, September 26, 1912. Spores nearly spherical, 7.4 x 7.9 μ.

437. Woods southeast of athletic field, September 24, 1912.

454. Near Howell's branch, September 28, 1912.

470. Battle's Park, back of Dr. Pratt's, September 30, 1912. Spores spherical or somewhat elliptical, 7.4-8 x 7.4-9 μ.

572. Near Howell's branch, October 17, 1912. Veil deliquesces to a yellow ring. Spores spherical.

570. Woods south of campus, October 14, 1912. A depauperate specimen. This little plant was only 3.3 cm. broad and 4.2 cm. high. The veil in this case had deliquesced to a yellow ring as in the large specimen of 572. The spores were those of a normal plant, nearly spherical, 7.5-10 x 10-11.5 μ.

707. Woods south of Dr. Battle's house, June 20, 1913. A typical plant of *A. verna*, but the spores were elliptic, 6.3-7 x 7.8-11 μ.

749. Woods near Meeting of the Waters. Spores short elliptic, 5.8-7.5 x 6.6-8.2 μ. Veil in two specimens water soaked and yellow.

783. In woods south of athletic field, September 17, 1913. Spores of this were spherical, 6.5-11 μ in diameter.

913. This fine plant, typical in every other respect, had the central part of the stem split away all around from the marginal part; that is, there was a central core about 4 mm. in diameter standing free in a distinct cylinder.

1257. On bank of Battle's branch, just above the first bridge, September 24, 1914. Photo.

1261. In grass in Dr. Wagstaff's yard, September 24, 1914. Photo.

1273. In damp loam in woods above Meeting of the Waters, September 28, 1914. Spores spherical, 6-8.5 μ.

1480. Woods west of "The Rocks," November 19, 1914.

2075. Shaded lawn at the old Mangum place, June 12, 1916. A very small form. Spores elliptic, smooth, 6.6-7.4 x 8.5-11.8 μ.

Flat Rock. Memminger.
Blowing Rock. Atkinson.
Asheville, common. Beardslee.
Common in woods. Curtis.

6*a*. **Amanita verna** Bull. Form with two-spored basidia.

A. bisporigera Atk.

PLATES 16 AND 64.

We have in Chapel Hill, as at Ithaca and other places, a smaller and earlier form of *A. verna* in which the basidia bear only two spores, and not rarely, in our plants, only one. As it is like *A. verna* in other respects and seems to vary into it, I shall treat it as a form of that species. I have found basidia with only two spores mixed with the four-spored ones in the typical, large plants of *A. verna*. Perhaps there is simply a tendency to the two-spored state in *A. verna*, which becomes dominant in the smaller plants. This smaller form appears as early as June, extends through the summer into September. It may be described as follows:

Cap 2.5-7 cm. broad, shiny, slightly viscid, quite smooth or with patches of the membranous volva in center. Margin slightly striate, and when just out of the volva, beautifully fibrous for about 1 cm. Color pure white all over to pale tan with the center abruptly darker, about rufous. The cap is at times marked with short, sharp, elevated ridges which seem to push up under the cuticle. Flesh white, very thin, about 2 mm. thick at center, thinning very quickly to less than 1 mm.

Gills rather close, many short, just reaching the stem, about 6 mm. deep in center, rounded at both ends, white.

Veil white, very thin and membranous, not flocculose below or fragile, attached about 0.5 to 1 cm. from the cap and hanging collapsed against the stem.

Stem slender, tapering upward, 7.5-15 cm. long, 3.5-6 mm. thick in center, abruptly enlarged below into a short, soft bulb, which has no tapering point below, surface smoothish or somewhat fibrous, white; flesh solid, no central cylinder.

Volva adnate to the bulb, with a conspicuous, free and usually split border which is very thin and papery, or moderately thick, and which extends about 0.5 to 1.5 cm. above the bulb.

Spores white, spherical, smooth, 7.2-11 μ in diameter; basidia two-spored.

This form was first described by Prof. Atkinson from Ithaca, N. Y. (Bot. Gaz. 41: 348. 1906) and our No. 152 was determined by him as this species. Our notes on this number were incomplete, and as we had not again distinguished the plant in Chapel Hill for several years we had about given it up as identical with *A. verna* until the early summer of 1915 when two plants were found (No. 1567), which struck us immediately as different from *A. verna*, being more slender and with some color in the cap when old. Examination of the basidia showed them all to be two-spored. Since then a number have been found.

152. Top of Lone Pine Hill, Glenn Burnie Farm, in mixed woods, September 19, 1908.
1567. In low woods not far from Battle's branch, below last path to Piney Prospect, June 21, 1915. Photo. Spores spherical, 7.2-9 μ.
1586. By path along Battle's branch, near the first seat below first bridge, July 6, 1915. Photo. Spores subspherical, smooth, 8-10.8 μ. A single small plant, 3.5 cm. wide and 7 cm. high. Basidia examined and found to be all two-spored. Cap white except for cream-colored center.
1598. Low place near Battle's branch, July 12, 1915. Photo. One small plant 2.5 cm. wide and 7.5 cm. high. Cap pure white all over. Basidia all two-spored. Spores subspherical, 9-11 μ.
1645. In leaves under a beech tree near Battle's branch, July 26, 1915. Spores spherical, 8-11 μ, usually about 9 μ in diameter, only two to a basidium, rather often only one spore matures on a basidium, the other remaining rudimentary (see drawing).
2165. Woods near Meeting of the Waters, June 20, 1916.
2159. Grass under oaks, Prof. Howell's yard, June 20, 1916.
2271. Under oaks at "The Rocks" and at Gimghoul Lodge, and in Battle's Grove, July 27, 1916. Photo.

7. **Amanita hygroscopica** n. sp.

PLATES 17, 18 AND 64.

Cap 4.5-6 cm. broad, rounded or gibbous, smooth and wet-looking, viscid, the margin even or with delicate lines, nearly plane,

pallid white, the center shading to straw or pinkish-straw color. Flesh only 2 mm. thick near center, nearly white, odorless and tasteless, not changing when bruised.

Gills 4-4.5 mm. wide, moderately close, rounded at stem and just reaching it, white then discolored to fleshy-buff or flesh-color.

Veil white, thin, delicate, almost always torn and hanging as a collapsed and fragmented ring about 1.5-2 cm. from the cap.

Stem up to 8 cm. long, including the bulb, 5-6 mm. thick in center, tapering upward, nearly smooth, white or with a few stains of brown below, ending in a good-sized or large bulb to which is attached an adnate volva with a free limb about 5-10 mm. long which is collapsed on the stem; center of stem with a rather distinct central cylinder which is rather lightly stuffed, but not hollowed except by grubs.

Spores white, elliptic, smooth, 6.6-7.8 x 10-11.5 μ, most about 6.6 x 10.5 μ.

Edibility not known.

This is most like the small, two-spored form of *A. verna* in size and general appearance, but is really quite different. It is distinguished from this form and from the typical *A. verna* by its wet cap (a quality which remains obvious in the central region for hours after the plant is placed in the dry air); the gills turning distinctly flesh colored; the very softly stuffed central cylinder, which is usually quickly hollowed by grubs; the more fragile and torn veil; the very different, elliptic spores; and the greater brittleness and fragility of all parts.

From *A. elliptosperma,* which is nearest structurally, it differs in smaller size, distinct central cylinder, absence of flocculence on veil and stem, lower attachment of veil, and in the wet cap, and distinctly larger spores. See drawing.

From *A. spreta* it differs in color of cap and gills, in the bulbous stem with adnate volva, and in the smaller spores of different shape.

2261. Under oaks in manured soil around small hemlocks, lawn of "The Rocks," June 26, 1916. Photo. Type.
2275. Same place as above, June 28, 1916. Photo.

8. **Amanita magnivelaris** Pk.

A. elliptosperma Atk.

PLATES 19, 20, 21 AND 64.

A large and conspicuous species that is not rare in mixed and deciduous woods. Cap up to 10 cm. broad, often elliptic or one-sided, chalky white or light cream, shining, slightly viscid, and with no sign of warts except occasionally a trace of friable material toward the edge, or with a large flat piece of the volva; margin not striate. Flesh white, unchanging, almost tasteless and odorless.

Gills light flesh-colored, with many short and sometimes forked ones.

Stem pure white, 8-15 cm. long and 0.9-2.5 cm. thick in center, slightly tapering upward, scarcely bulbous below except for the enlargement due to the thick volva which is fused with its base. Below the free limb of the volva extends a more or less pointed root, usually 2 or 3 cm. in length. Surface typically flocculent on the upper half or nearly the whole length where the veil touched it in youth. Sometimes nearly glabrous, except above, often more or less torn below; flesh solid all through; no distinct central cylinder.

Veil very fragile but not friable, attached at very top of stalk and remaining attached to it as an ample skirt, or in many cases breaking away and sticking to the gills in fragments, or hanging to the edge of the cap. It is very delicate, thin, and *densely soft-flocculent* on the lower side (not with coarse, mealy, friable particles as in *A. chlorinosma*), but does not deliquesce to a slime in wet weather.

Volva thick, tough, leathery, persistent, usually splitting irregularly and remaining at the base of the stem as large flaps or slivers, rarely approaching a perfect cup. It is usually, but not always, much thicker and heavier than in *A. verna*. Some times one or rarely two or three large flat pieces may be torn off and remain sticking to the cap.

Spores elliptic, with a very small eccentric mucro, usually about 5.5-7.4 x 8-11 μ. Sometimes 13 μ long, and occasionally (as in No. 1806) much smaller.

Edibility not known.

This species has not been well understood in America and is not recognized by Murrill or Beardslee. It is, however, very distinct and seems to represent a connecting link between the phalloides and chlorinosma groups. I have placed it in the former group because of the large volva and absence of chlorine odor, but it is in reality probably more closely related to the latter, as shown by the flocculent, fragile and quite apical veil, the flocculent stem with rooting base and the shape of the spores. It is probably nearest *A. virosa.*

Amanita elliptosperma was described from our plants by Prof. Atkinson (Annales Mycologici 7: 366. 1909). I have examined the type of *A. magnivelaris,* and have no doubt that it is a good species and that it is almost certainly the same as *A. elliptosperma.* In the fresh state this species can be distinguished without difficulty from *A. verna* without any reference to the spores. In my observations of many plants of these two species, extending over six years, I have found no confusing intermediates. In *A. magnivelaris* the veil is quite fragile and not deliquescent, is attached at the very top of the stem and is *densely soft flocculent* below, the stem is also flocculent above or all over, is terminated below by a more pointed bulb, and is, typically, considerably stouter than in *A. verna.* The gills are light flesh color and the spores are elliptic. In *A. verna* the veil is attached about 1 cm. from the cap, is less fragile but apt to fade or deliquesce, and is not flocculent below, the stem is not flocculent, and the gills are pure white.

As described by Peck, *A. magnivelaris* would be considered doubtfully distinct from *A. verna,* but the radicating base, as noted and as shown clearly in his plants, is an important point, and the spores, which I have carefully examined, are *not* like those of *A. verna,* but are identical with those of *A. elliptosperma.* While the spores of *A. verna* are not rarely elliptic and may approach those of *A. magnivelaris* in shape, there are to be found others in the same plant much more nearly round than any in the latter species; moreover, they average rounder in any spore print of *A. verna* and the mucro is larger. Another difference is in the appearance of the spore contents after standing in the herbarium. Those

of *A. verna* are of a homogeneous oily appearance with eroded spots, while those of *A. magnivelaris* from New York and from Chapel Hill also as a rule are distinctly granular and not oily. It is true that Peck describes his plants as having a glabrous stem, but this does not seem to be of great importance, as the amount of flocculence is variable and is reduced by exposure or by handling.

It is probably this species to which Curtis refers without name in the Berkeley-Curtis MSS. as follows:

"2869. (Spec. nom cum desc. quadrat volva non a dist.) Cap plane or plano-concave, 3 in. wide, smooth and glabrous, with a few irregular patches of the volva near center, margin not striate. Lam. dirty white with a yellowish tinge, subdenticulate. Spores copious, white. Ring attached just under the gills. Stipe 4-5 in. long, solid, white, squamulose, dilated when joining the cap, bulbous at base. Volva loose at the margin, divided into 4-5 laciniæ. July-October. Earth."

160. Woods by road southeast of cemetery, October 24, 1910. Spores 5.9-6.6 x 9.7-10.8 μ.
161. Open woods east of Gimghoul Hall, September 17, 1908.
452. Woods near Dr. Battle's house, two photos. Here the volva was torn into heavy thick flaps, which would sometimes remain attached to the cap in part. Spores 6-6.7 x 7.8-10 μ, most about 4.8 x 8.5 μ.
553. Open woods in several places around Chapel Hill, October 9, 1912. Two photos. Plants of this collection had the entire stem minutely flocculent like the under surface of the veil.
782. Mixed woods back of athletic field, September 17, 1913. Spores 5.5-7.4 x 8.3-11.1 μ.
928. Battle's Park, October 16, 1913. Spores elliptic, 5.5-7.4 x 7.4-11 μ.

9. **Amanita mappa** Fr.

A. floccocephala Atk. *A. lignophila* Atk. (?)

As the form of *A. mappa* at Chapel Hill has certain distinct peculiarities, I give below a description of the Asheville plant by Beardslee as more typical:

"Pileus 2.5 in. broad, yellow or pallid, dry, with flat white or yellow scales from the fragments of the volva, even on the margin; gills white, slightly adnexed; stipe stuffed, then hollow, white, striate at the apex, with a globose marginate bulb. Spores globose, 8 μ.

"Found in pine woods, rather rare. This is identical with the plant which is found in Sweden. It is much like *A. phalloides* in some regards, but has no free volva. The basal portion of the volva is adnate to the bulb and is cut squarely across, forming a thick margin at the margin of the bulb."

The species is said to be poisonous. Ford and Sherrick (Jour. Phar. and Exp. Ther. 4: 327. 1913) say: "Heated extracts had no effect upon rabbbits, but produced a chronic intoxication in guinea pigs from which the animals died in about ten days. . . . The specimens we have examined are certainly free from muscarine and closely resemble *Amanita phalloides* in their properties." From later experiments Ford and Brush find that, "In all probability *Amanita mappa* contains both Amanita-hæmolysin and Amanita-toxin, but in much smaller quantities than *Amanita phalloides*" (Jour. Phar. and Exp. Ther. 6: 192. 1914).

I have examined the type plant of *A. floccoccphala* Atk., and find it like *A. mappa* in the dried state. I could not find any spores. Atkinson's description of this form is as follows (Studies of Am. Fungi, p. 62):

"This species occurs in woods and groves at Ithaca during the autumn. The plants are medium sized, 6-8 cm. high, the cap 3-6 cm. broad, and the stems 4-6 mm. in thickness.

"The pileus is hemispherical to convex, and expanded, smooth, whitish, with a tinge of straw color, and covered with torn, thin, floccose patches of the upper half of the circumscissile volva.

"The gills are white and adnexed.

"The spores are globose, 7-10 μ.

"The stem is cylindrical or slightly tapering above, hollow or stuffed, floccose scaly and abruptly bulbous below. The annulus is superior; that is, near the upper end of the stem, membranaceous, thin, sometimes tearing, as in *A. virosa*. The volva is circumscissile, the margin of the bulb not being clear cut and prominent, because there is much refuse matter and soil interwoven with the lower portion of the volva. The bulb closely resembles those in Cooke's figure (Illustrations, 4) of *A. mappa*."

Amanita lignophila Atk. (Ann. Mycol. 7: 366. 1909) is probably also a form of *A. mappa*. It is described as follows:

"Plants 5 cm. high, pileus 2.5 cm. broad, stem 3 mm. stout; bulb abrupt, rotund, 12 mm. stout. Pileus dull grayish brown, smooth or with fine floccose remnants of the volva, viscid when moist. Gills sordid, very crowded, subventricose, adnexed and decurrent in striæ, edge finely fimbriate. Basidia 30-35 x 8-10 μ, four-spored. Spores globose, granular, 8-10 μ. Stem pallid, even, solid, fibrous-striate and slightly mealy below the annulus, above the annulus finely floccose, mealy. Annulus ample, membranous, persistent, white, 1 cm. from the apex. Volva thick, grayish brown, limb free.—C. U. Herb.

"On dead branches in woods beyond Forest Home, near Ithaca, N. Y., autumn, 1898. Name published with a few non-diagnostic notes, in Rep. N. Y. State Bot. for 1904, Bull. 94, N. Y. State Mus., p. 19, 1905."

I have examined the spores of the type plant of *A. lignophila* and find them spherical, 6.6-7.5 μ by my measurements.

10. **Amanita mappa** var. **lavendula** n. var.

PLATES 22, 23 AND 64.

Cap from 3.5 to 8 cm. in diameter, flat or slightly depressed in center (sometimes slightly gibbous in center) a light but distinct primrose yellow (not the dull egg yellow shades of *A. russuloides*), often with stains of light brown, lavender, purple lavender, or a combination of these; somewhat viscid when damp, shining when dry, smooth except for the occasional flat, irregular, lavender or pink-lavender patches of the volva. Margin distinctly striate when mature, or the striæ may be scarcely visible until the margin begins to dry. Flesh nearly white, sometimes quickly turning to shades of lavender when cut, quite thin, only 2 mm. thick at center of gills, smell when freshly cut like raw green peanuts.

The gills are pure white, free but close to the stem and connected by a line which runs down a little way, deepest near their middle, where they are from 3.5 to 7 mm. deep according to the size of the plant; many short ones, none forked.

Stem up to 10 cm. long and from 6 to 10 mm. thick in center, smooth and somewhat silky-shining, faint primrose yellow above and nearly white below the veil, but often with cream, brown, or lavender tints, and brown where bruised, solid but sometimes nearly hollow from the separation of the looser central fibers, no distinct central cylinder.

Bulb large and abrupt, but variable, sometimes 2.8 cm. in diameter, soft and spongy generally with an abruptly truncated top, which may be quite smooth or show slight marginal projections representing the volva. There is no volval cup. The surface is a distinct lavender color, sometimes pinkish or brownish lavender or rarely nearly white (as in No. 1399, but even in this collection the volva patches on the cap were lavender), internally it is white.

The veil is primrose yellow, thin, delicate, but not flocculent or friable, the lower side often showing the fibers by which it was attached to the stem. It breaks away perfectly from the cap edge and remains attached to the stem from 2 to 3.5 cm. below the cap, generally collapsing tightly against the stem, and so delicate at times that it is scarcely noticeable on the mature plant except where its free edge marks out a colored line against the stem. At other times the veil remains expanded for some time as a perfect skirt, and is quite perfect in the mature plant. Above the veil the same yellow tissue covers the stem to the cap, but as the stem elongates this tissue becomes scattered and also fades in color.

The spores are white, spherical, with a slight umbo. They vary considerably in different plants. Those from collection No. 399 average about 10 μ; those from No. 410, about 6.5 μ in diameter; and in No. 570, from 6 to 7 μ.

Not rare in pine or mixed pine and deciduous woods, or on rotting pine wood. As the typical *A. mappa* is poisonous, it is probable that our variety is also.

Our Chapel Hill plant is evidently near *Amanita mappa* Fr., and in stature and general appearance closely resembles that species, particularly the drawings of it given by Lucand in Champignons de France, folio 51. 1881. It may be sharply distinguished from the typical European *A. mappa* by the lavender volva and the primrose-

yellow veil. Beardslee finds *A. mappa* at Asheville and describes it as having a "yellow or pallid" cap, and he writes me that the veil, as he remembers, was primrose-yellow. He has no record of a lavender volva. In the Curtis herbarium there is a plant of *A. mappa* from the Santee Canal, South Carolina (Ravenel No. 1161), in which the veil is described as yellowish. There is no reference to a lavender volva. In Europe the cap is said to be variable, usually white or yellowish. I can find no published reference to a yellow veil. Our plant is so constant and distinct as to require at least a varietal name.

In all probability having the poisonous qualities of the typical plant.

165. Battle's Park, October 2, 1909.

166. Battle's Park, near leaning tree, November 2, 1909.

399. Woods, October 26, 1911. Photo.

410. In pine woods, southeast of campus, November 7, 1911. Photo.

427. Battle's Park, mixed woods behind Dr. Wilson's, September 24, 1912. Photo.

430. Battle's Park, mixed woods behind Dr. Wilson's, September 24, 1912. Photo.

510. Woods east of school house, October 5, 1912.

570. Along Howell's branch, above ravine, October 17, 1912.

590. Along Howell's branch and along branch from toward Strowd's, October 18, 1912. Photo. Color of cap primrose yellow tinted with green and lavender.

644. On a rotten pine log, Lone Pine Hill, October 26, 1912.

853. In dense pine grove, southwest of old brick yard in Tenny's meadow, September 18, 1913. Spores of this collection were spherical, pure white, 5.5-7 μ in diameter. Bulb was light pinkish lavender, purplish lavender stains on cap, no volva patches on cap.

1355. Woods south of campus, October 15, 1914. Spores white, spherical, with mucro, smooth, granular appearance, 6.4-9 μ.

1399. On bank above branch 1/8 mile below Meeting of the Waters, October 21, 1914. Photo.

1430. Woods near Emmerson's Dam, Bowlin's Creek, October 26, 1914.

1432. Woods by Battle's branch a short distance above first bridge, October 27, 1914. Photo. A very fine plant 8 cm. in diameter and a distinct lavender bulb and cap patches, a fine veil of clear primrose yellow.

1924. In mixed woods ¼ mile southwest of graded school, October 25, 1914.

1971. In a rotten stump in woods below Mr. Strowd's, November 8, 1915.

11. Amanita gemmata (Fr.) Gill.

A. junquillea Quél.
A. russuloides Pk.
A. nivalis Pk.
A. velatipes Atk.
Amanitopsis albocreata Atk.
A. crenulata Pk.
A. glabriceps Pk.
A. phalloides striatula Pk.
A. multisquamosa Pk.
A. amici Gill.

PLATES 24 AND 65.

Plants very common in woods and not rare in shaded lawns, especially if recently manured; gregarious and often crowded, varying from very small to moderately large, the cap being up to 8.8 cm. broad, and the stem up to 12 cm. long. Cap shining and viscid or becoming dry in dry weather and usually with a few or many soft white volva patches, which, when small, tend to be pyramidal; edge very distinctly tuberculate-striate; color usually a light egg yellow, varying to creamy tan or brownish tan or grayish brown, fading to straw or pallid on the edges as the plant ages; occasionally very small plants will be very light, even in youth. Flesh thin, white, usually odorless, but sometimes, as in collection No. 693, with a decided odor of smoked ham.

Gills white, not much crowded, broadest at marginal end where they are 6-7 mm. deep, close to the stem and attached to it by a line, connected at the very thin pileus by obvious raised veins. Their margins when young are delicately flocculent from the fine fibers that connected them to the stem. The inner ends of the short gills are squarely truncate as in *A. cothurnata.*

Veil, when present, white, thin, not hanging like a shut umbrella as in *A. phalloides,* but forming an extended ring which is attached from 1.5 to 4 cm. below the cap; more often than otherwise it is entirely absent, the plants then simulating an Amanitopsis.

Stem 5-12 cm. long, usually tapering upward, the base enlarged into a bulb; stuffed in center; surface white, smooth toward the top except for the descending lines from the gills; below it is more or less fibrous and often split and slivered on the surface. The bulb is rather abrupt, occasionally quite smooth, but usually marked at the stem base by the slight or conspicuous remains of the volva.

consisting of a perfect or fragmented collar, which sometimes is found at a considerable distance up the stem; occasionally the collar is thicker and more rounded, approaching the appearance of forms of *A. cothurnata.*

Spores short-elliptic to subspherical, smooth, with a large oil drop, rather variable in size, usually about 7.4-8 x 10-11 μ.

Edible in all probability. Ford and Brush find that extracts of *A. junquillea* contained no hæmolysin and were entirely free from poisonous action upon both rabbits and guinea pigs, and are inclined to regard the species as free from poisonous properties (Jour. Phar. and Exp. Ther. **6**: 193. 1914). *A. russuloides,* which is the same, was also found to be harmless by Ford (Jour. Phar. and Exp. Ther. **1**: 284. 1909). On the other hand, Ford finds that *A. crenulata* contains a small amount of a poison like that in *A. phalloides,* killing guinea pigs and rabbits (Jour. Phar. and Exp. Ther. **2**: 294. 1910). Peck reports that *A. crenulata* has been eaten without harm. McIlvaine says of *A. nivalis* Grev. (probably meaning *A. nivalis* Pk.) that it is harmless, but bitter when cooked.

Colored illustration: Murrill, Mycologia **8**, No. 5, Plate 190, Figs. 2 and 3. 1916.

In the behavior of the veil this species is most unusual. Peck (Rep. N. Y. St. Mus. **25**: 73. 1873) says that the annulus is thin, soon vanishing; and Beardslee (Jour. E. Mitchell Sci. Soc. **24**: 124. 1908) finds the Asheville plants to have no annulus or a very rudimentary one. In our plants, while the veil is probably more often absent, it is frequently conspicuous and permanent.

In size, shape and general appearance this species is most like *A. cothurnata,* and in some cases, where the volva rim is low and even, the similarity is great, especially as the volva rim of *A. cothurnata* is not always so rounded or neatly rolled as the descriptions call for. This may be seen in one of the plants in Atkinson's figure 68 of *A. cothurnata* (Plate 17, Mushroom Book), and my photo of No. 510.

A. gemmata is our only Amanita that is partial to manured soil.*

* With the possible exception of *A. hygroscopica,* which has been found so far only in cultivated and manured soil around evergreens.

It is very near *A. cothurnata* (see remarks under that species), but typical forms may be distinguished from that species by the *gills not being remote from the stem but attached to it by a line,* and the volva not forming a neat and even roll. The egg yellow color of the former is usually also distinctive, but in pale forms will not help. The spores do not form a means of distinction.

I have followed Beardslee and Maire in considering *A. junquillea* Quél. the same as *A. russuloides* Pk., and Maire in considering both of these as synonyms of *A. gemmata* (Fr.) Gill. For still other names for this plant see Maire, Annales Myc. 11: 334. 1913. Bressadola, Boudier and Rea have all seen Beardslee plants and unite in referring them to *A. junquillea.* The good figure accompanying Boudier's discussion of this species in the Bulletin of the French Mycological Society 18: 253, cannot be distinguished from our plant.

Our plate No. 24 shows variations in a lot of plants from one colony, but does not show the larger plants called by Atkinson *A. velatipes* (Studies of Am. fungi, p. 63). Such large plants are common here, together with a complete set of intermediates, and show the same peculiarities in the behavior of the volva. The peculiar volval rings mentioned by Atkinson, that may be found at some distance above the bulb, are often seen in our plants whether with or without a true annulus higher up. I have examined the type plants of *A. velatipes* and find the spores and other characters the same as in ours. I have also examined the types of *A. glabriceps* Pk. (N. Y. St. Mus. Bull. 131: 18. 1909) and *A. multisquamosa* Pk. (N. Y. St. Mus. Rep. 53: 840. 1899), which is a light form, and find them just like *A. gemmata.* The spores, too, are identical with the latter in both cases. In his description of *A. glabriceps,* Peck states that his *A. phalloides striatula* is a form of that species. *Amanitopsis albocreata* Atk. (Jour. Myc. 8: 111. 1902) and *Agaricus nivalis* Pk. (Rep. 33: 48. 1880) are also almost certainly *A. gemmata.* Miss Eaton's colored figures of *Venenarius (Amanita) glabriceps* and *Vaginata (Amanitopsis) albocreata* are just like our plants (Murrill: Mycologia 8: No. 5, Plate 190). *A. crenulata* Pk. is a form with rudimentary veil and

subspherical spores. I have measured the spores of the type and found them 6-6.7 x 7-7.8 μ (see Plate 65). It is reported as edible. In a later note (N. Y. St. Mus. Bull. 94: 19. 1905) Peck refers to this plant with more striate margin and more yellow cap. The type was described as being whitish or grayish, sometimes tinged with yellow, the margin somewhat striate (Bull. T. B. C. 27: 15. 1900).

146. Low place east of athletic field, September 25, 1908.
419. Oak grove at "The Rocks," September 19, 1912. Cap a clear egg yellow. No veil. Spores 5.5-7 x 7-9.3 μ. See drawing.
429. Mixed woods, Battle's Park, behind Dr. Wilson's, September 24, 1912. Cap a clear egg yellow; the volva collar about 1 cm. above base of stem.
430. Woods, Battle's Park, east of Dr. Wilson's, September 24, 1912. Photo.
511. Woods east of school house, October 5, 1912. The volva in this collection acted in a very confusing way. Portions of it were often stripped off a good way up the stem, so as to simulate a veil or ring. Others were entirely devoid of any volva remnants, except at the base. Spores about 7.4 x 11.2 μ.
693. Dr. Wagstaff's shaded lawn, July 15, 1913. Very abundant. Spores elliptic, 7-8.7 x 9.2-11.8 μ. The plants of this collection varied from 2.2-9.5 cm. in diameter of cap; veil present, forming a durable annulus. A distinct smell of old ham. The lawn had been well manured last fall. A few plants of this species were found to-day on the campus in grass near alumni building.
709. Woods near branch in Battle's Park, July 20, 1913. Not uncommon now
735. Rich woods west of "The Rocks." September 11, 1913. Photo. Just as in collection No. 511. Spores elliptic, variable, most about 6.6-7.5 x 9-11 μ, a great many larger, up to 11 x 13.7 μ.
750. Woods near Meeting of the Waters, September 12, 1913. Just like No. 735.
1095. Dry woods east of cemetery, July 8, 1914. A clear and beautiful light yellow in center.
1334. Battle's Park, north of the cemetery, near road to Piney Prospect, October 13, 1914. Spores smooth, white, elliptic, 7-7.8 x 10.3-11 μ.
1353. Woods just south of campus. Spores elliptic, with lateral mucro at one end, sometimes one large oil drop, often several smaller ones, smooth, 5.5-8.5 x 6.4-11.9 μ.
1706. In soil among trash piles in woods just south of graded school, September 8, 1915. Photo.
2046. In grass under trees by Gimghoul Lodge, June 9, 1916.
2054. In manured borders in Dr. Brown's yard, June 11, 1916. Photo. Spores 5.2-6 x 7-7.8 μ, a few larger or smaller. (Drawing.) Some of these plants were very large, and all had veils.

Asheville, very common (as *A. junquillea*). Beardslee.
Flat Rock (as *A. russuloides*). Memminger.

12. **Amanita cothurnata** Atk.

A. pantherina Fr. (?)

PLATES 25, 26 AND 65.

Cap up to 7 cm. broad, usually about 4.5-5.5 cm., plane or the margin turned up, viscid, the margin distinctly tuberculate-striate, marked with irregular patches or warts which are easily removable and often washed away. The color is quite characteristic and with us is very constant. It is a pallid white on the margin, shading gradually to a light pallid buff in the center (the immediate center becoming more abruptly darker); only occasionally, as in collections No. 1123 and No. 1725, is the color pure white all over or only the center creamy. Flesh membranous at margin, about 4.5 mm. thick at stem, pure white.

Gills rather crowded, distant from stem and not connected with it by a line, and no lines on top of stem, much broader near the rounded distal end, where they are about 5 mm. deep, veined by lines at the cap. There are a good many short marginal ones which are remarkable for their squarely truncate inner ends.

Stem about 7-11 cm. long, and 2-7 mm. thick near top, enlarging gradually downward and terminating in a distinct bulb. Surface of stem white, very smooth above, often fibrous below. A distinct central cylinder is present and is lightly stuffed or nearly hollow.

Veil thin, membranous, smooth above, softly felted below, often irregularly torn in expanding, usually remaining as a more or less perfect ring on the stem 1-4 cm. from the cap. Universal veil, pure white, completely fused with the bulb and sticking to the cap as more or less persistent warts, leaving as a rule a very distinct and thick rolled margin at the top of the bulb, but sometimes with a thinner, more irregular and less characteristic margin.

Spores white, elliptic, smooth, 6.6-7.8 x 7.6-11 μ.

Colored illustration: Murrill, Mycologia 5: Plate 87, Fig. 6, 1913.

This species is very near *A. pantherina* Fr. of Europe and may

be identical. The "usually white" color that Atkinson gives as a character of *A. cothurnata* does not hold in this locality, though the cap is occasionally white here and is usually white at Asheville (Beardslee, Jour. E. Mitchell Sci. Soc. 24: 118. 1908). The white plant from New York called by Peck var. *albescens* of his Oregon species *A. calyptrata* (N. Y. St. Mus. Rep. 53: 840. 1899) is almost certainly this. The yellowish color mentioned by Atkinson as occurring at times is the rule here. The spores are given as globose or nearly so by Atkinson, but they are really short elliptic as Beardslee states (Jour. E. Mitchell Sci. Soc. 24: 119. 1908), and as often confirmed by me. I have examined spores from a plant collected by Atkinson at Blowing Rock and find them as in our plants, 6.6-7.5 x 9.3-10 μ, most about 7.4 x 9.7 μ. See drawing. They are filled with a very large conspicuous oil drop, as Atkinson notes, which makes them appear more globose than they really are. Spores of *A. panthcrina* collected by Beardslee in Sweden were examined by me and were found to be identical with old spores of my collections of *A. cothurnata,* and contained a similar large oil drop, which in both species was usually eroded, much as a starch grain is when being digested. The spores of this Swedish plant were 7-8 x 8.5-11 μ.

Poisonous (?). There seem to be no edibility records for this, but it poisons flies (Mycologia 2: 259. 1910), and *A. pantherina,* which is very near if not the same, is known to be poisonous like *A. muscaria,* but in milder form (Mycologia 2: 261. 1910). However, working on plants from Stow, Mass., Ford and Sherrick report that extracts "were without effect upon blood corpuscles and exhibited no toxic action upon rabbits or guinea pigs" (Jour. Phar. and Exp. Ther. 4: 326. 1914).

Among our own Amanitas *A. cothurnata* is most like *A. gemmata* in general appearance, and after seeing hundreds of plants of both species, I am doubtful if they are sharply distinct. The neatly rolled volval margin and straw-colored cap of *A. cothurnata* varies into the thinner and more torn volva and deeper yellow cap of *A. gemmata,* and those, with usually more remote gills, are the only points of difference that I can find. The deeper yellow color

seems to accompany a richer soil. Miss Eaton's drawings of *Amanita* species, determined by Murrill as *A. glabriceps* and as *Amanitopsis albocreata* (Mycologia 8, No. 5, Plate 190. 1916), cannot be distinguished from our *A. gemmata,* while Peck's figures of *A. glabriceps* (Bull. N. Y. State Mus. 131: Plate U. 1909) are very like *A. cothurnata,* as figured by Atkinson (Studies of American Fungi, Figs. 68, 69, 70), except for the absence of warts, and these are frequently lacking in the latter.

427. Battle's Park, back of Dr. Wilson's, September 24, 1912. Caps pallid cream, center smoky cream. Photo.

430*a*. Battle's Park, behind Dr. Wilson's, September 24, 1912. Photo. Cap pallid smoky cream, ring not collapsing but standing out horizontally.

510. Woods east of school house, October 5, 1912. Two photos. In this collection the annulus when young and perfect looked like a hat and did not hang down. Cap a light pallid yellowish or brownish tan, usually with volva patches. Gills pure white; spores short-elliptic, a large oil drop, 7.4 x 8.3 μ.

551. Open woods, Battle's Park, October 10, 1912. Spores short-elliptic, averaging about 7 x 8.8 μ.

1116. Woods, Battle's Park behind Mrs. Gore's house, July 11, 1914. Spores elliptical, 7-7.4 x 8-9.6 μ.

1123. Sandy soil by Morgan's Creek below King's Mill, July 12, 1914. Photo. Cap pure white, or creamy white in center.

1144. Near shrub by road in Dr. Venable's lawn, July 15, 1914. Photo (with No. 1145).

1145. Under bushes between road and campus near east gate, July 16, 1914. Photo (with No. 1144).

1316. Battle's Park, northwest of Brockwell's spring, October 9, 1914. Spores elliptic, 6.6-7.8 x 8.8-11 μ.

1337. Battle's Park, north of cemetery, October 13, 1914. Spores when fresh elliptic, 6.8-7.6 x 7.6-10 μ. Measured again after more than a year, results were 6.6-8.1 x 7.4-10 μ, some not far from spherical, but great majority distinctly elliptic.

1354. Woods south of graded school, October 15, 1915.

1553. In mixed woods south of athletic field, June 18, 1915. Spores 7.2-7.6 x 7.6-9 μ.

1647. In leaves under a beech tree near Battle's branch, July 26, 1915. Pallid tan in color.

1725. Among leaves, open woods east of east gate of campus, September 10, 1915. Photo. These plants were very light colored, several being almost pure white except for a small creamy or buffy spot in center.

1754. In woods half way up Lone Pine Hill, September 12, 1915. In two of these plants the veil was on the middle of the long stems, about 6 cm. from the cap.

Blowing Rock. Atkinson.
Asheville. Beardslee.
Flat Rock. Memminger.

13. **Amanita muscaria** Linn.

Venenarius roseotinctus Murrill. *A. onusta* Howe.

PLATES 27, 28 AND 65.

Cap from 3.2-11 cm., usually 6-8 cm. wide in Chapel Hill; at the north and in our mountains averaging somewhat larger; surface adorned with soft, flat or warty patches of ashy gray or light yellow color which may be absent over considerable areas and occasionally entirely washed off in rainy weather; between these patches the surface is smooth, shining, and viscid when moist; margin usually not striate, but often, especially in small plants, distinctly so; color usually some shade of salmon, a fine rosy salmon in center fading to light yellowish salmon on margin or red salmon in center and orange salmon on margin. In large plants, which are rare in Chapel Hill but common in the North, the color is darker, being a deep orange red, about mars orange or lighter orange. As the plant ages the color may fade until it becomes a very light pallid salmon or even an ashy gray. Peck says that the plant may at times be wholly white, and calls such forms var. *alba* (N. Y. St. Mus. Rep. 33: 44. 1880). Flesh up to 1 cm. thick at stem, very thin toward margin, a clear yellow near the surface, a light yellow or cream inside.

Gills rather close, just reaching the stem and usually slightly adnexed, broadest near the margin where they may be 9 mm. deep, pointed at stem, rounded at margin, color almost pure white, faintly yellow and dotted on the edge when fresh with *sticky particles,* connected with veins at the cap. The short gills have the free end cut off squarely, perpendicular to the cap (truncate).

Stem 5.5-14 cm. long, 5-15 mm. thick at top, nearly even to the strongly bulbous base, almost white or ashy brown, light yellow and with a quite sticky powder above the veil when young, smooth

or somewhat fibrous-flocculent below, loosely stuffed or hollow, enlarged below to a short oval bulb, which is a brownish ash color. The bulb may be almost smooth, but is nearly always marked on the upper third by small and large lines and ridges of the volva, and these may extend some way up the stem.

Veil thin, usually yellowish, sparingly fibrous below, usually attached from 2-3 cm. from the cap, but sometimes lower, thicker and deeper colored on the margin. It separates from the cap and holds to the stem as a perfect ring or as a number of partial rings and fragments, or may be so torn as to fall away entirely. In depauperate forms the veil may be entirely absent (see description of No. 1794). When perfect the ring is quite handsome with its thick ashy brown crimped margin and perfect form. Rarely the volva markings on the bulb take the form of a low but distinct membranous margin.

Spores (of No. 880) creamy white in bulk, elliptic, smooth, 6.3-7 x 7.5-8.1 μ.

Deadly poisonous; but atropine is an antidote.

Colored illustrations: Taylor, in Rep. of the Sec. of Agri. for 1892, Plate 2; Atkinson, Mushrooms, Plate I, Fig. 1; Marshall, Mushrooms, Plate opposite page 41; Murrill, Mycologia 5: Plate 87, Fig. 3, 1913; Gibson, Our Edible Toadstools and Mushrooms, Plate 4, p. 55.

These plants are particularly fond of dry pine woods, occurring rather frequently in groups in pure pine or in mixed pine and deciduous woods, and very rarely (No. 1388 and No. 1794) under oaks alone. It may be found year after year in the same spots.

This is *Venenarius roseotinctus*, Murrill, which is established on rather small specimens of salmon color, found in sandy soil in mixed woods at Biloxi, Miss. The southern tendency in the species is toward a smaller size, salmon color, and pine-loving habit. Both extremes occur here and are connected by a complete series of intergrading forms.

I have no doubt that *A. onusta* Howe (Bull. T. B. C. 5: 42. 1874) is this species, the veil in the plant described being more ephemeral than usual, though the plants were not dwarfed as de-

scribed for the form below. The gray warts, even margin, concentrically squamulose bulb and especially the *viscid, farinose* stem exclude all other species and agree with this. The brownish gray cap is not exclusive. The plant referred by Peck to *A. onusta* (N. Y. St. Mus. Rep. 53: 839. 1899) is not that species, but a form of *A. chlorinosma.*

67. Mixed woods, Battle's Park, October 28, 1910.
173. Dry pine woods, side of road by cemetery, October 24, 1910. Spores elliptic, 8 x 11 μ.
408. Near path under pines at foot of old volcano on east side, October 29, 1911. Several photos. Large plants; spores 7-7.7 x 10.3-10.8 μ.
544. Battle's Park, October 10, 1912. Photo. The margins of these plants were strongly striate.
880. In dry, poor pine and oak woods by side of road about 300 yards southeast of cemetery, October 5, 1913. Three photos.
884. By path cutting through woods just beyond Morgan's Creek on the road to Smith's Level, October 5, 1913.
885. By path near the foot of the "Volcano," east side in pine woods with dogwood underbrush, October 5, 1913.
1135. Campus in grass north of soldiers' monument, July 13, 1914.
1388. At foot of black oak just north of alumni building, October 19, 1914. This plant was 7.2 cm. wide, a light salmon clay color. Stem sparingly granular-flocculent. Short gills squarely truncate at free end Spores nearly white, elliptic, smooth, 6.6-7 x 7.7-9.6 μ.
1442. In bank beside road in hollow, about a mile southwest of cemetery, October 28, 1914.
1540. In poor sandy soil, pine and oak woods near east gate of campus, June 7, 1915.
1911. Under pines, Piney Prospect, October 21, 1915. Photo. Large red plants, small salmon forms, and intermediates. Spores 6.3-8.1 x 7.4-10 μ, a few smaller.
1953. Hillside north of King's mill dam, under *Pinus virginiana,* October 31, 1915. Two photos. Spores short elliptic, smooth, granular looking or the oil gathered in a large drop, 6-7.6 x 8-10 μ.

Asheville, rather rare. Beardslee.
Blowing Rock. Atkinson.
Flat Rock. Memminger.
Middle district in woods (Schw.). Curtis.

13*a*. **Amanita muscaria** Linn. Depauperate form without veil.

PLATE 29.

Cap up to 8 cm. broad, strongly depressed in center, margin nearly plane and finely striate for 5-7 mm., surface with rather

low, sharp, pyramidal warts, about 1-1.5 mm. thick at base, the margin and cap surface between the warts more or less finely flocculose-scaly, color a light creamy tan. Flesh white, soft, 3 mm. thick at stem, a membrane toward the margin.

Gills crowded, creamy, just reaching the stem, 8 mm. wide in middle, rather pointed toward the margin, the short ones squarely truncate, glutinous on the edges which are granular dotted (suberoded).

Veil entirely absent, or making a faint circle on the stem.

Stem, including bulb, 5.5 cm. long, 1 cm. thick near center, expanding at cap and enlarging downward to an oval bulb, which is margined on the neck by several rows of little cogs. Surface of stem cream color, the superficial layer *strongly glutinous,* bulb below the cogs *not* so.

Odor of plant not strong, but noticeable and like slightly spoiled ham, not the chlorine odor of *Amanita chlorinosma.*

Spores spherical to subspherical, white, smooth, 7.2-10 μ in diameter.

Stems of typical *muscaria* are also sticky, but they are usually not so intensely glutinous as in these aberrant plants, which are so sticky that the whole plant can almost be lifted by touching the finger to the stem.

Even large plants of *A. muscaria* may have an ephemeral veil, that does not form a ring on the stem. Such a form is *A. onusta,* which is intermediate between this and the typical plant.

1794. In dry sandy soil with sparse grass, in Dr. Venable's lawn, September 11, 1915. Two plants, one 8 cm. wide and one stunted and cracked by dry weather and only 2.8 cm. wide.

1967. Poor sandy soil, pine woods, on road to Mason Farm, November 7, 1915. This is just like No. 1794 except for a faint salmon tint, and traces of a veil on the margin: 5 cm. wide and 5 cm. high. Spores elliptic, smooth, 6.6-7.7 x 11-11.8 μ.

1979. In dry pine woods north of Brockwell's, November 12, 1915. This is intermediate between the above and the typical *muscaria.* Cap only 2.5 cm. wide, mostly white; veil very delicate, drying up on the gills; gills and stem above very viscid; stem only 1.5 cm. long above bulb.

Asheville, rather rare. Beardslee.

14. **Amanita spissa** Fr.

A. Morrisii Pk. *A. submaculata* Pk.

PLATES 30, 31 AND 66.

Cap 4.5-8.5 cm. broad, plane or slightly convex, sometimes gibbous, slightly viscid, usually with rather few, scattered, soft, thickish, gray or brownish-gray warts, at times quite free from warts; margin even or irregular, usually smooth, but sometimes lightly striate for about one cm., rarely faintly flocculent; color typically Saccardo's umber in center, the margin lighter, but varying to wood-brown or blackish umber in center and vinaceous-buff or pallid umber on margin. Flesh pure white, not changing when cut, thin, 3-4 mm. thick near center, quickly thinning to a mere membrane on margin, odorless and almost tasteless, at times somewhat astringent.

Gills pure white, moderately or distinctly crowded, few or many short ones, just reaching the stem by a point and with a descending line, narrow, usually 3-5 mm. wide, rarely up to 9.5 mm. wide in large plants, very light on drying.

Veil ample, thin, not friable, pure white on both sides or brownish below, lined above by the gills, hanging as a skirt about 5-15 mm. from the cap, and usually soon collapsing against the stem.

Stem 6-11 cm. long, 8-14 mm. thick near center, nearly equal or tapering upward, almost smooth or below the veil fibrous, ending below in a tapering or rather abrupt bulb of variable size, which is rather firmly set in the ground; there is usually no trace of a volva on the bulb, but there may be a few flat, inconspicuous lines or ridges or powdery particles near the top; color of stem white above the veil, varying below from grayish umber or wood-brown to white. Flesh solid, firm, elastic, no central cylinder, very rarely somewhat hollow above.

Spores usually very variable in size in the same plant, smooth, white, a large oil drop, elliptic, with an eccentric mucro, 4-6.7 x 6.5-9 μ, most about 5 x 8.3 μ, a few up to 8 x 11.5 μ. Some small spores are found in most plants, but in some the spores run consistently small (as in No. 2215).

This species has been reported but a very few times in America. It has been found twice and given two names by Peck. I have examined carefully his type plants of *A. Morrisii* and *A. submaculata* and find them the same. Peck describes the cap of *A. Morrisii* as smooth and so figures it, but several plants of his type collection have warts just like our *A. spissa.* A plant of *A. spissa* from Sweden, kindly sent me by Beardslee, is the same in all essentials. The species is most like *A. rubescens* and *A. excelsa.* From the former it is easily distinguished by its unchanging flesh and umber or wood-brown color; from the latter by its smaller size, less fibrous stem, much thinner veil, pure white gills, and less fragile flesh. The spores are the same as in *A. excelsa.*

Edibility not certain. It was eaten and pronounced savory by McIlvaine, but it is not certain that he had the same plant that I have referred to this species. Ford found to be edible a plant from Massachusetts thought by Peck to be intermediate between *A. rubescens* and *A. Morrissi* (Jour. Phar. and Exp. Ther. 6: 205. 1914). It was probably *A. spissa.* Later Ford reports that *A. Morrisii* has a small amount of poison and is toxic to guinea pigs and rabbits (Jour. Phar. and Exp. Ther. 2: 292. 1910).

548. Near Battle's Park, back of Prof. McKie's, October 10, 1912. Cap up to 7 cm. broad, smoky gray in center, exactly color of *A. spreta.* No sign of a volva anywhere except a few little patches above the bulb. Spores elliptic, averaging about 6.6 x 8.1 μ.

842. By Battle's Brook, September 25, 1913. Photo. Spores elliptic, very variable, 4.8-6.7 x 6.5-9.4 μ. Reddish stains on stem and bulb, bulb not emarginate.

930. In pine woods by path south of athletic field, October 18, 1913. Two photos.

Cap 7.5 cm. broad, flat, smooth, no warts, and not striate at all on the margin. Vinaceous-buff (Ridgway) except toward center, which shades to wood-brown, with several stained spots of a deeper chestnut-brown. The margin is distinctly inherently fibrous, and the remainder is mottled somewhat like a pheasant's breast, only rather indistinctly. Flesh of cap white, thin, about 2 mm., deep half way to the margin, unchanging. Spores white, smooth, elliptic, 4.5-5.5 x 6.5-7.5 μ.

1133. In grass on campus near monument, July 13, 1914. Spores elliptic.

1330. Lawn of "The Rocks," under oaks in grass, October 13, 1914. Photo.

Cap 8.5 cm. broad, flat, slightly striate for about 1 cm. on the margin, smooth and shining, a few scattered small flattish warts of a soiled gray

color, vinaceous buff on margin to avellaneous in center; flesh pure white except just under the surface, where it is color of cap, unchanging. Gills about 8 mm. wide in center, many short ones. Spores pure white, elliptic, 5-6.5 x 7.5-8.5 μ.

1344. In pine woods south of athletic field, October 14, 1914. This is exactly like 1330, except there was no meal on bulb. Color of cap and of volva patches is light vinaceous buff. Cap 7.5 cm. wide. Spores elliptic, 4.5-5.5 x 6.6-7.5 μ. Like those of No. 2260.

1987. Poor soil, mixed woods, Battle's Park, November 12, 1915. Photo.
Cap 5.8 cm. broad, flat, no volva patches, blackish umber in center, much lighter pallid umber toward margin. Gills rather crowded, 3.5 mm. wide, pure white and unchanging, their margins eroded. Veil ample, thin, smooth, upper side distinctly lined by the gill edges, white. Stem grayish umber below, white above the veil, solid, slightly bulbous, the bulb with several flat ridges. All parts unchanging when bruised. Spores smooth, elliptic, very variable in size, 4-5.2 x 6.3-8.7 μ.

2166. By western Meeting of the Waters branch, June 20, 1916. Spores 4.8-7 x 6.3-8.2 μ.

2178. By path by branch near Meeting of the Waters, June 21, 1916.
This is the form that was named *A. Morrisii* by Peck. Cap free of warts, Saccardo's umber in center; margin not striate; flesh not changing; gills crowded, narrow, white; stem slightly enlarged at ground, solid, white, but becoming brownish when rubbed. Veil becoming brownish below. Spores pure white, smooth, short-elliptic, 4.5-6 x 6.5-8.5 μ.

2194. Poor mossy soil under oaks in Dr. Venable's yard, June 21, 1916. Photo.
Remarkable in having some of the stems hollow at the top; color Saccardo's umber, warts brownish gray. Spores pure white, smooth, elliptic, 4-5.2 x 6.6-8.1 μ.

2206. Mixed woods southwest of Mr. Pritchard's, June 22, 1916.
This is the form named by Peck *A. submaculata*. Cap up to 8 cm. wide, umber in center with a few flat, grayish volva patches on some and none on others, distinctly inherently fibrous toward the margin, but not at all striate except faintly on the fading margin of old plants. Gills up to 9.5 cm. wide in largest plant, and stem 11 cm. long, not hollow in age, and with no distinct cylinder in center; base enlarging gradually as in *A. rubescens*. Veil in some breaking and hanging to the margin. The cap of the largest plant shows the umber color somewhat mottled, and also shows the curious white dots that led to Peck's name. These dots are mostly about 1-1.5 mm. wide, elliptic to subspherical, and are due to the absence of the superficial layer at these points as if separated and pulled apart, without apparent cause. Such dots are present to a less extent in several other collections.
Spores 4.8-6.3 x 7.5-9 μ, most about 5 x 8.3, a few up to 8 x 11.5 μ.

2215. Under oaks, lawn of "The Rocks," June 24, 1916. Two plants, one 8.5 and one 9 cm. broad; surface rather pale umber and only slightly lighter on margin, which is inherently fibrous and faintly striate, only

a few scattered white spots, sunken dots, and a very few small particles of the volva. Gills, veil, stem, etc., as described for other numbers. Spores 4-4.5 x 6.5-7 μ.

2220. Under oaks by Gimghoul Lodge, June 24, 1916. White on marginal half, ochraceous umber in center, with conspicuous and large, flat, grayish brown warts. Spores white, elliptic, smooth, 4.4-7.4 x 7.4-11 μ.

2260. Lawn of "The Rocks," June 26, 1916. Spores average about 4.4 x 7 μ.

2274. Lawn of "The Rocks," June 26, 1916. Spores average about 4.4 x 6.7 μ.

15. **Amanita spissa** var. **alba** n. var.

PLATE 66.

Cap about 7.5 cm. broad, gibbous in center, the margin plane or slightly elevated; surface pure white, dull or faintly shining, slightly viscid, damp, marked with the same deep little pits and shallow larger pits that so often appear on *A. spissa* in North Carolina, two or three small flat patches of the volva which is apparently white at first, then brown on drying; margin striate for about 0.5-1 cm. Flesh soft, white, only about 5 mm. thick in center, tasteless and odorless, not reddish when bruised.

Gills hardly crowded, just free, nearly pure white (faintly creamy), broadest in middle where they are about 8 mm. wide.

Veil nearly apical, very thin and delicate collapsing into a thin brownish-dusky membrane against the stem.

Stem about 3½ inches long, smallest in center; surface lightly fibrous, white then brownish when handled, soft-fibrous in center, but not hollow or with a distinct central cylinder, base with a small oval bulb with a few faint flat patches of the brownish or pinkish-brown volva.

Spores elliptic, smooth, a decided, eccentric mucro, 4.2-5 x 6.3-7.5 μ. Drawing.

This is just like *A. spissa* except for the pure white color. The brownish stains on the stem, when rubbed, are also often noticed on the typical plant.

Hartsville, S. C. (No. 11). Flat woods under long-leaf pine, Ellis place, southeast of Hartsville plantation, September 9, 1916. Plants lost, but spore print saved.

16. **Amanita excelsa** Fr.

Amanita ampla Pers.

PLATES 32, 33, 34, 35 AND 67.

Cap up to 15 cm. broad, at first convex, then plane or the margin elevated, surface dull or slightly shining, moderately or scarcely viscid, and with a separable cuticle, usually smooth at maturity except for scattered warts, which are usually thick and flat or bluntly pyramidal and rather irregular in size, about 3-8 mm. in diameter. When young and undisturbed the margin is covered with a soft, easily removed flocculence which shades into warts. Margin sometimes striate for about 1 cm. when mature, more often not striate. Color a smoky tan or straw, about drab, in center, a very light pallid straw, almost white, on marginal half. Flesh white, soft and very fragile, about 1 cm. thick at stem, odorless.

Gills fleshy, white, rather crowded, narrow, about 6 mm. wide, narrowed toward the stem, just reaching it when young, detached or even remote when mature.

Stem up to 10 cm. long above ground, usually stout, tapering upward, bulbous or scarcely enlarged below, lightly or deeply rooted; surface smooth above the veil, decidedly fibrous-flocculent below it, or becoming smoothish toward the base, white, or the flocculence sometimes creamy buff or light salmon color. Bulb without volva patches, or more or less marked on the top by soft, obscure ridges and flakes. It was noticeable that the first plants to appear in the summer of 1914 (July 15th, about) after a long drought were much more deeply rooted than was usual in the fall. Flesh of stem solid all through with no stuffed central cylinder.

Veil usually attached about 1-1.5 cm. from the cap, but at times almost at the very apex, fairly thick when young, with a thicker marginal roll, thinner in age, flocculent below, exactly as in *A. spreta* and acting exactly as in that species, *i. e.*, perfect and ample at first, but fading and collapsing to a membrane against the stem, or, unlike *A. spreta*, often breaking and falling off on account of its fragility; color pure white or the flocculence and marginal roll creamy buff or light salmon, not turning smoky.

Spores pure white, elliptic, averaging about 5 x 8 μ, with or without an oil drop when fresh.

The plants are usually very large, but are fragile throughout, more so than any other of our Amanitas. They are rather common in dry woods, mixed and deciduous, in sandy loam or clay.

Fries states that *A. excelsa* is poisonous, but Mrs. I. M. Jervey, of Arden, and her friends have eaten for years the plant described above. The evidence as to the edibility of many species is contradictory.

This species is nearest *A. spissa,* which see for points of distinction. After examining the illustrations of *A. excelsa* by Gillet (as *A. ampla*), Cook, Paulet and others, I am satisfied that our plant is the same. Fries gives the habitat as pine woods.

The species seems to have been reported from America only by Curtis, but the plant so labeled in the Curtis herbarium is not *A. excelsa,* but *A. chlorinosma,* which is obvious from its appearance and from Curtis' note, "odor gravis."

From the *solitaria* group the species is separated by much greater softness and fragility, by separable cuticle, simpler and more fragile veil, and characters of the bulb; from the *strobiliformis-chlorinosma* group it differs in greater fragility, separable cuticle, flesh-color of the gills, and absence of chlorine odor.

514. Woods east of school house, October 5, 1912. Photo. Spores 4.8-6 x 6.6-8.5 μ. Drawing.

521. Woods across small branch south of campus, October 7, 1912. Photo.

736. Mixed woods south of athletic field, September 12, 1913. No volva marks on bulb or only a few lines; cap when young drab in center, light drab or almost white on margin, in age fading to pallid shades of brownish grays and yellows. Spores white, elliptic, 5.5-7.4 x 7.4-9.2 μ.

755. Mixed woods east of graded school, September 13, 1913. One of these two plants was pure white, our first pure white specimen, the other was white on margin, light smoky gray in center. Stem quite flocculent from veil to near base; no free volva, only delicate lines on and above bulb; veil thin, fibrous-flocculent below, hanging about 1.5 cm. from cap; scarcely any volva patches on cap; edge not striate.

794. Battle's Park, September 19, 1913. Photo. In many plants of this species brought in during the last few days (collection No. 794 is part of these) the veil has been a delicate light salmon color on the thick outer edge, often all over on under side, only lighter. At the margin of the cap

the veil is thicker, and this thick ring breaks up in expanding into patches as shown in photo of No. 521. These patches are the most strongly colored. Veil fibrous-flocculent beneath, not at all pulverulent as in *A. chlorinosma* and not so fragile as in that species. Stem without a central cylinder, but often fibrous inside and frequently riddled by grubs. Spores, white, elliptic, 4.6-5.5 x 5.5-7.4 μ in one plant; 4.6-5.5 x 6.5-9.2 μ in another; 5.5-7.4 x 7.4-8.3 μ in another; and 4.6-6.5 x 8.3-10.3 μ in another.

903. Battle's Park, near path to Piney Prospect, October 8, 1913. Photo. Spores 5.5-7.4 x 7.4-11 μ.

1098. Battle's Park, at edge of corn field, just south of Dr. Battle's house, July 8, 1914.

1141. Oak grove east of Arboretum, July 16, 1914. Photo.

1571. On ground by path along Battle's branch, June 22, 1915.

2111. In clay by road to Purefoy's Mill, June 14, 1916.

2117. Under oaks in front of Gimghoul Lodge, June 16, 1916.

Arden, September 23, 1915. One fine fresh plant sent by Mrs. I. M. Jervey, who says that the plants are edible and that she eats them regularly. Spores 5.1-5.5 x 7.4-9.2 μ, No. 1872.

17. Amanita rubescens Fr.

A. asper Fr. (?)

PLATES 36, 37, 38 AND 67.

A very abundant, large or sometimes small plant that is solitary or gregarious in groves and woods, but is usually not very conspicuous on account of its being colored in harmony with its surroundings. Cap expanded, up to 11 cm. broad, faintly striate on margin, very variable in color, cinnamon-brown, pallid light cinnamon, sordid red-brown, pallid tan, buffy-brown, etc., or white, in variety *alba*, stained with reddish or brownish where rubbed, and in most cases covered by soft, flattish or pyramidal warts of the same color which are scattered over the surface, sometimes with beautiful regularity, sometimes only partially, or they may be almost or quite absent. They are quite distinct from the cap surface and easily removed. Surface between the warts viscid when moist. Flesh soft, white, slowly turning reddish when cut, up to 5 mm. thick at stem, very thin on margin; nearly odorless and tasteless.

Gills pure white, close, never branching, narrow, up to 5 mm. wide and nearly the same width throughout, just reaching the

stem by a point, veined at cap, margin fimbriate-eroded. When bruised they may or may not turn red.

Stem up to 20 cm. long, including the bulb, usually stout, up to 1.4 cm. thick at cap, enlarging gradually downward to the more or less bulbous base, or rarely with an abrupt bulb. Surface lightly flocculent-fibrous or smoothish, lighter than the cap usually, often with purplish tints, frequently stained with reddish and brownish when rubbed. Flesh firm outside, stuffed within, white and sometimes red when cut, never hollow. Bulb usually oval, smooth, with or without circles of small flat darker dots on its upper half.

Veil thin, ample, not friable, softly tomentose below, color of stem or yellowish or reddish or ashy buff, etc., hanging like a skirt and attached about 1 cm. from the cap, often torn in shreds and leaving no trace on the stem.

Spores (of No. 703) oval, 6.3-7 x 7.9-8.7 μ.

Edible, but it is very important to remember that the deadly *A. phalloides* has a very similar veil and bulb and often turns reddish after some time when bruised, so that none but the most typical forms of *A. rubescens* should be eaten. Unless one has considerable knowledge of the genus, it is best to let all the Amanitas alone.

Colored illustrations: Atkinson, Mushrooms, Plate 19, Fig. 2. Murrill, Mycologia 6: Plate 113, Fig. 1, 1914.

Not rarely there are met with in Chapel Hill small forms in this group that are difficult to refer with certainty. The cap is usually without warts and with light color, such as naples yellow, yellowish tan, light brown, gray-brown, etc. The stem is more or less enlarged below and usually with volva patches. The flesh of the cap may not change when cut, but the stem will usually turn brown when rubbed. Unless some yellow volva patches could be found I have referred these to *A. rubescens* without being at all sure that they were not *A. flavorubescens* or *A. spissa*. Such small forms are often very much like small plants of *A. phalloides*, but may be distinguished by absence of any volva margin on bulb, by the gills reaching the stem, and by the elliptic spores. In very doubtful cases I have relied on the spores.

167. Mixed woods, Battle's Park, September 21, 1908.

168. Open woods east of Gimghoul Lodge, September 11, 1908.

175. Mixed woods, Battle's Park, ground covered with leaves and other debris, September 14, 1910.

425. Growing on a gravelly soil at edge of meadows, September 21, 1908. Photo.

513. Woods near old school house, October 15, 1912.
Typical large plants. Spores short elliptic, 5.5-6.7 x 7.4-9 μ, most about 6.3 x 7.7 μ.

571. Near Howell's branch, October 7, 1912.
Cap 5.7 cm. wide, brownish tan with reddish-brown stains and lines, warts few, color of cap; margin slightly striate when mature. Spores elliptical, 4.4 x 7.4 μ.

703. Woods near Battle's branch, June 20, 1913.

743. Woods on south side of meadow, Glenn Burnie Farm, September 12, 1913.

751. By path just west of athletic field, September 12, 1913.
This is a depauperate form that seems to be *A. rubescens*. Largest cap 4 cm. broad, 2.5 cm. in smallest. Color grayish brown, striate on margin. Scattered white volva patches on top. Veil thin, hanging as a skirt about 0.5 to 1 cm. from the top. Gills just reaching the stem. Stem bulbous, no trace of a volva on it, turns brown when bruised, 6.5 cm. high in largest plant. Spores elliptic, 4.5-5.5 x 7.4-8.2 μ.

752. Woods west of school house, September 13, 1913.
These two little plants are like above, but show more characters of *A. rubescens; i. e.*, stains of reddish on cap and stem, volva patches color of cap when young.
Both this collection and No. 751 are distingnished from *A. phalloides* by smooth bulb and stem and size and shape of spores.

1129. Pine grove at top of Lone Pine Hill, July 12, 1914.
Plants small, only 3-4 cm. wide. Spores elliptic, about 5.5 x 7.4 μ on average.

1778. At base of a pine stump and apparently coming from under it, woods north of barn, Glenn Burnie Farm, September 14, 1915.
This plant, 6 cm. high and 7 cm. broad, varies much from the typical *A. rubescens*. The pileus is "buffy brown" (Ridgeway) with only the very slightest red stains, white volva patches on top. Veil thin, part hanging compressed against the stem, part hanging from the edge of the pileus. The gills are white, crowded, narrow, just reaching the stem. Neither the cap nor the gills change color when bruised. Stem more typically *A. rubescens*, slightly enlarged at base, with reddish tint, especially toward the base, and red where bruised. This may be *A. spissa*.

1828. In path in woods near branch above Meeting of the Waters, September 19, 1915. Photo and drawing of spores.
Color near pallid or dull cinnamon, warts darker, soft, flattish, discrete and easily removed. Veil dusty-clay color below. Stem light purplish brown. Spores white, elliptic, smooth, 5-6.6 x 7.4-8.2 μ.

2144. Pine woods south of Mr. Tom Ellis' house, June 18, 1916.
Cap naples yellow with tint of green. Spores elliptic, most about 4.8 x 7.5 μ.
2148. Mrs. Kluttz's yard, by office, June 19, 1916.

Asheville, fairly common. Beardslee.
Flat Rock. Memminger.
Low district, damp woods. Curtis.

18. **Amanita rubescens** var. **alba** n. var.

PLATE 67.

We have in Chapel Hill a pure white, rather large plant with red stains when bruised and with the spores of *A. rubescens*. I have referred it to that species as variety *alba*. It is characterized as follows (description drawn from No. 2346):

Cap 9.5 cm. broad; surface white, viscid, no warts, staining reddish brown when bruised; margin faintly striate. Gills rather close, same width all length, only 3.5 mm. wide, white, but turning light ochraceous when bruised. Veil delicate, fragile and hanging from top of stem in collapsed strips. Stem fibrous inside, no central cylinder, gradually and slightly enlarged below, with light lines of deep red-brown color from the volva, also stains of red where bruised and flesh reddish below. Spores elliptic to pip-shaped 4.5-5.5 x 7-8 μ.

2346. Woods by road to Scott's Hole, June 3, 1916.
2355. Battle's Grove, oaks, July 3, 1916.
Same characters as No. 2346 except that there are a few brownish-red warts on the cap, and there were distinct striations on the margin. Spores 4.5-5.2 x 6-7.5 μ.

19. **Amanita flavorubescens** Atk.

PLATES 39, 40 AND 67.

Cap up to 8 cm. broad, usually about 5-6 cm. Convex and then nearly flat and somewhat umbonate, dull or slightly shining, smooth except for the mustard yellow patches of the volva which are low, soft, scattered, and easily removed; margin slightly striate; color peculiar, the center being auburn, which shades to a lemon yellow on the margin, the two colors usually mixed and ex-

tending radially in streaks. In age the yellow usually fades somewhat, the brown predominating. Flesh thin, only about 2 mm. thick near the stem in large plants, white, but yellow just beneath the thin, easily removable cuticle, turning to a dull brownish red when broken. Fresh plants are odorless, but they very quickly decay with an unusually vile odor. When just beginning to decay the odor is, on the contrary, quite pleasant, being much like that of a seckel pear; tasteless.

Gills white, free, gradually broadening to near the margin, where they are about 4 mm. deep, rather close, and folding on each other like the pages of a book.

Stem slender, up to 12 cm. long, usually about 7-9 cm., and 6 mm. thick in center, gradually enlarging downward and sometimes slightly bulbous. Covered all over when fresh with flocculent particles, which are at first yellow, but soon turn brownish red at the lower end, the upper part usually remaining white or yellowish. There is a distinct central cylinder, about 1.7 mm. in diameter, that is lightly stuffed.

Veil thin and delicate, but persistent, mustard yellow below, creamy yellow above. The under side is lightly flocculent and fibrous like the stem. It breaks away from the cap and hangs as a rather small skirt on the stem about 6 to 10 mm. from the top. The color fades somewhat in age, but the margin remains yellow.

Spores (of No. 1158) white, oval to elliptic, and with an oil drop, 4.4-4.8 x 6.6-7.8 μ.

Edibility not known.

Colored illustration: Murrill, Mycologia 5: Plate 87, Figs. 4 and 7. 1913.

This species is most like *A. rubescens,* but is easily distinguished from it except in depauperate forms by the color of the cap, the yellow volva and veil, the stem flocculence, and the distinct central cylinder in the stem. The latter plant was growing abundantly in the same swamp with this, and sometimes very near it, and they were conspicuously distinct, with no intermediate forms.

1158. Swamp of New Hope Creek, above and below Durham Road crossing, July 18, 1914. Photo.

2082. Swamp of New Hope Creek, 100 yards below bridge on Chapel Hill-Durham Road, June 13, 1916.

2167. Mixed woods between Sphagnum bed and branch, June 20, 1916. Two small plants, cap 3.5 cm. in diameter, of a light isabella color, darker in the center; and with a small yellowish volval collar near the base. Spores short-elliptic, 4.8-7.4 x 7.4-9.2 μ.

2226. In several places on the bank of New Hope Creek from the Chapel Hill-Durham bridge on the lower road, June 24, 1916.

Asheville, occasional. Beardslee.

19*a*. **Amanita flavorubescens** Atk. A form.

PLATES 41 AND 42.

Cap 3.7-10 cm. wide, distinctly gibbous-umbonate, viscid when wet, the margin plane and slightly striate, surface mostly smooth, but here and there granular warted like a frog, a few friable, lemon-yellow volva patches or none; color not at all that of the typical form, center pale buffy vinaceous or a deeper vinaceous (russet vinaceous—Ridgeway), fading to a pale fleshy straw on the margin. Flesh about 5 mm. thick near the stem, white but changing rather quickly to vinaceous when cut, tasteless and odorless.

Gills rather crowded, 7-9 mm. wide, rounded at stem and scarcely reaching it, broadest a little beyond the middle, in all these plants except the smallest one curiously branched and anastomosing in a dedaloid manner near the margin; color pure white, vinaceous when bruised.

Veil thin, membranous, hanging as a neat and perfect skirt about 1-2.5 cm. from the cap, pure white or the margin yellowish.

Stem 5-9 cm. long, tapering upward, 5-12 mm. thick at top, gradually swollen below and subbulbous, surface slightly fibrous below the veil, smooth above, white, but soon stained with brownish vinaceous; firm, flesh white, vinaceous when cut, a distinct central cylinder about 3 mm. in diameter that is permanently stuffed.

Volva lemon yellow, friable and remaining almost entirely in broken particles in the ground, just as in *A. Frostiana*, but even more soft and fragile.

Spores pure white, smooth, variable, subspherical to elliptic, 4.8-5.2 x 7.5-9 μ. Exactly as in the typical plant.

2133. Clay soil in open place in Battle's Grove (Oaks), June 17, 1916. Photo.

20. **Amanita Frostiana** Pk.

A. flavoconia Atk. *A. muscaria minor* Pk.
A. elongata Pk.

PLATES 43, 44 AND 67.

The Chapel Hill form described below is the typical *A. flavoconia* of Atkinson.

Cap up to 8.5 cm. in diameter, convex at first, then nearly flat and sometimes even with upturned edges; surface slightly shining and somewhat viscid when young, dull and dry when old; color orange-yellow, becoming paler and browner with age, and finally when quite old almost leather color. When quite young there are small scattered patches of the friable yellow volva on the cap, but these rarely remain present at maturity. The margin is not striate or very faintly so in some specimens (in the typical *A. Frostiana* the cap is said to be striate on the margin). Flesh very thin, only about 4 mm. thick at edge of stem and only 1.5 mm. thick half way to edge, white except just below the surface, where it is yellow.

Gills white, straight, rather close and deepest near the middle. They barely reach the stem and as the plant expands and the top of the stem widens they seem to stop some distance from it, but extend to it by a little line. As they get older the gills become light yellow with deeper yellow stains.

Veil very thin, but not friable, either remaining on the stem as a distinct annulus, about 1.5-2 cm. from the top, or hanging to the margin of the cap. Two of the five mature specimens of collection No. 698 had the veil attached to the margin of the cap and hanging in scattered tatters, while three had it on the stem as a distinct skirt. The veil is yellow on under side and white on top, but fades when old to white all over. The under side of the veil is slightly yellow flocculent, as is the stem below it.

Stem up to 13 cm. in length, usually about 6-7 cm., tapering upward from the distinct but not large bulb. When young and fresh it is yellow below the veil and white above it, in this way resembling the color of the two sides of the veil. The color above the veil is due to the extension upward of the same tissue of which the veil is composed, and, as shown by the cracks, the stem surface below this superficial tissue is yellow, as it is below the veil. The stem is solid and its flesh is white, except immediately below the surface, where it is yellow. The bulb tapers gradually both above and below, and often shows no trace of the friable yellow volva, which remains attached in deep yellow fragments to the adjoining earth. Sometimes there are visible lines of orange near the top of the bulb, marking the volva. As said above, the upper part of the volva remains on the cap in small friable patches which fall away by maturity. The base of the stem above the volva attachment is furnished with deep yellow flocculence, which extends more faintly as far as the veil.

Spores short elliptic, some with a large oil drop, some granular from the same plant (the granular ones being younger probably). Atkinson says (of *A. flavoconia*) that the spores are "quite constantly granular." They are (in No. 1112) 4-5.5 x 5.9-7.8 μ, most about 4.8 x 6.6 μ.

Amanita Frostiana has been considered poisonous by some, but probably only because of its supposed close resemblance to *A. muscaria*. Ford has found it to be perfectly harmless (Jour. Phar. and Exp. Ther. 1: 286. 1909).

Colored illustrations: McIlvaine, One Thousand Am. Fungi, Plate 6, Fig. 5; Murrill, Mycologia 5: Plate 87, Fig. 5, 1913.

Murrill (N. Am. Flora 10: 74. 1914) considers this species *A. Frostiana*, the same as *A. flavoconia*, but both Atkinson and Peck consider them different. Peck (Bull. N. Y. St. Mus. 67: 21. 1903) says of the latter: "Closely resembling *A. Frostiana*, Peck, in size and color, but distinguishable by the even margin of the pileus, the floccose edge of the lamellæ, and the fragile character of the volva, which easily separates from the slightly bulbous base and adheres to the soil that surrounds it. Both it and the annulus are a beau-

tiful chrome-yellow color." It will be noted, however, that our plants which are otherwise typical *A. flavoconia* are sometimes slightly striate on the margin (see photo of No. 1112), and the soft volva patches may form a distinct ridge on the bulb. Considering the very slight differences and the great variability of the Amanitas I hardly think it desirable to treat the two forms as distinct species. Peck says that *A. Frostiana* at times is pale yellow and the stem and annulus white, and gives this form the variety name *pallidipes* (N. Y. State Mus. Rep. 53: 855. 1900).

A. elongata Pk. (N. Y. St. Mus. Rep. 131: 33. 1909) is almost certainly this species, in which there is a tendency for the stem to be long and the cap small. I have examined the type and the spores agree well, being 5.5-5.9 x 7.5-8 μ.

In Chapel Hill this fine species is most common in summer. It occurs in all kinds of places; in lawns, pastures, upland woods and ravines, and in both clay and sandy soil. In climbing Mt. Mitchell in August, 1913, I found this species to be not uncommon in the damp, cool, mossy balsam groves of the high flanks and summits. It was the only Amanita seen that day at so high an altitude.

In placing this species near *A. muscaria* it seems to me that others have been mistaken. It is, I think, nearest to *A. flavorubescens*.

172. In woods east of Schizomeris pool, October 1, 1909.
698. In open campus near center monument, June 19, 1913.
705. In woods near Battle's branch, June 20, 1913. Spores 4.8-5.2 x 5.9-7.5 μ.
758. In moss near Battle's Brook, September 14, 1913. Photo.
805. Near Battle's branch just east of Dr. Battle's house, September 26, 1913.
862. In woods south of graded school; October 2, 1913.
1112. Oak woods south of Mrs. Gore's house, July 10, 1914. Photo.
1126. Woods near King's Mill, July 12, 1914.
1167. Deep rich woods at Lone Pine Spring, July 21, 1914.
1431. Woods northwest of Brockwell's Spring, Battle's Park, October 27, 1914.
1558. Wooded hillside near branch west of Meeting of the Waters, June 19, 1915.
1822. Woods by Howell's branch, September 15, 1915. Photo.
One small plant. Cap 3.3 cm. broad, center with thick, flattish yellow warts, margin not striate or faintly so in places. Color deep reddish orange in center, much lighter ochraceous yellow on margin. Gills light ashy yellow, close, 4 mm. wide, margin eroded. Stem 3.3 cm. long, 4 mm. thick, a small, smooth, oval bulb, finely flocculent-pubescent and orange below veil and over most of bulb, no friable patches of volva adhering,

light cream and pruinose above. Veil yellow pubescent below, creamy above, forming a medium skirt on the stem. Spores smooth, oval-elliptic, 5.2 x 7.5 μ.

2098. Battle's Park, near branch, June 14, 1916.

Blowing Rock. Atkinson.
Asheville, not rare. Beardslee.
Flat Rock. Memminger.

21. **Amanita solitaria** Bull.

A. monticulosa B. and C.

PLATES 45, 46, 47 AND 68.

A large, conspicuous plant growing singly in open woods.

Cap up to 14 cm. wide, pure white or old ivory and silky shining, viscid when moist, adorned in center with large, pointed, pyramidal warts up to 4 mm. high, which decrease in size toward margin and merge at very margin into low, finer flocculence, which is not at all friable and does not come off freely. The warts may be more or less washed off in wet weather, but when dry they are firmly attached. The flesh is pure white, solid, firm and without the slightest odor of chlorine in our southern form at least.

Gills white with a tint of flesh color when fresh, quickly bent upward at stem and just missing it. They are very deep, 1.2 cm. not far from the margin (where they are deepest).

The veil is very interesting. It is not at all friable, but is fibrous, ample, and compound in the sense that in addition to the upper strong layer, which is attached at the very top of the stem, there are strong and abundant fibers and sheets that extend from the lower surface of the veil to the stem for almost its whole length. As the stem lengthens these fibers are pulled loose, leaving lines and wisps until about 3 to 5 cm. from the top, when they become more dense and there form a series of conspicuous, cottony, partial rings and wisps, which are strong and persistent, but may collapse against the stem. In tearing from the cap the veil often leaves a tattered fringe hanging from the cap margin, and rarely the veil may become almost all torn loose from the stem.

Stem up to about 11 cm. long above the bulb and 1.5 cm. thick in center, almost equal, ending below in a large, but not abrupt,

bulb that is usually much extended below into a rooting base. The stem surface is white and is usually marked with wisps and fibers of the veil over its upper half or more, the lower part often with slivers, cracks and ridges, which are larger downward and nearly always mark the upper part of the bulb. A distinctive character usually exhibited by the stem is the well-marked central cylinder about 7 mm. in diameter which is stuffed permanently with rather fine, dense, white cotton that is always whiter than the outer part and *does not water soak* as the central cylinder does in *A. abrupta.* This stuffed white cylinder is not always clearly marked. Sometimes it cannot be made out at all, but the soft homogeneous cottony center, whether or not it is sharply outlined, is quite different from the coarse, fibrous, often lacunose, center of *A. strobiliformis, A. chlorinosma* or *A. excelsa.* It is much smaller and more densely stuffed than in *A. spreta,* where the very fragile cottony stuffing collapses on being exposed.

Spores of No. 814 elliptic, 7.4-9.2 x 11.1-13 μ.

Edible. Some European authors say that this species is poisonous, others that it is edible, but all Americans who have tried it pronounce it edible and good. Ford has found that the raw plant contains a poison which acted upon blood corpuscles. It is probably destroyed on cooking (Jour. Phar. and Exp. Ther. 1: 280. 1909).

Colored illustration: Murrill, Mycologia 8, No. 5, Plate 190, Fig. 1, 1916. (?) This does not look like our southern form of this species.

A. solitaria varies in the following points:

1. The cap, especially in rainy weather, may crack up into rounded slivers in center and most of the warts may be washed off. Also there may be shades of light soiled brown or even ash color in center, and much darker forms are said to occur in the North.

2. The gills may be lacerated and cut up into narrow plates and teeth over much of the surface like the pore surface of Lenzites at times. Three specimens of No. 823 show this well.

3. The abundant lower fibers of the veil mark the stem differently in each case. Sometimes there is almost a second perfect ring several cm. below the more ample upper one. Sometimes

there are scattered partial wisps and ridges all over the stem; sometimes these fibers tear away so evenly as to leave the upper part of the stems almost evenly fibrillose.

4. The dense stuffing of the central cylinder, which is usually present, may occasionally become separated from the surrounding flesh so that it can be lifted out as a plug.

5. The bulb may be stained with brown or reddish brown.

6. Quite small, depauperate forms are occasionally found.

While our southern plant has no odor of chlorine, both McIlvaine and Hard mention an odor of chloride of lime. Neither Peck nor Atkinson speak of an odor, but Fries says the taste and odor are "fatuus," whatever that may mean. The species has so often been confused in America with forms of the chlorinosma group that mistakes in regard to the odor might easily have crept in.

Amanita solitaria may be most easily distinguished by the veil, which is unlike any of our other species except *A. abrupta*. The veil of *A. strobiliformis* is not fibrous below, but softly tomentose flocculent, and is not compound, while that of *A. chlorinosma* is farinose, very fragile and quickly falls off.

I have examined the type plants of *A. monticulosa* in the Curtis herbarium and find them to be this. The spores are identical.

171. Woods on road to Scott's Hole.
177. Battle's Park, open mixed woods, October 14, 1910.
304. Battle's Park, open mixed woods, September 28, 1910.
450. Woods south of Dr. Battle's, September 27, 1912. Photo.
453. Woods east of campus, south of Dr. Battle's, September 27, 1912.
475. Woods east of school house, October 2, 1912. Two photos.
651. Dry woods, Battle's Park, September 19, 1910.
652. Battle's Park, open mixed woods, October 14, 1910.
814. Woods back of Dr. Howe's, September 21, 1913. Spores white, elliptic, 6.6-7.7 x 11-13.7 μ.
823. Battle's Park, September, 1913. Gills cut and toothed; spores white, elliptic, with lateral mucro at one end, one large oil drop; in one plant, 6.5-11 x 11-14.8 μ, in another 7.4-11 x 11-13 μ.
987. In woods east of road to Purefoy's Mill, October 15, 1913.
1113. Woods south of Mrs. Gore's house, July 10, 1914. Photo.
1122. Sandy soil near Scott's Hole, July 12, 1914. Photo. This was a very small, depauperate plant only 4 cm. wide by 6 cm. high, but it was typical in characters in every way. Spores elliptic, smooth, 6-9 x 9-12.6 μ.

2358. By road to Scott's Hole, July 3, 1916.

Blowing Rock. Atkinson.
Common, sandy woods (as *A. monticulosa*). Curtis.

22. Amanita abrupta Pk.

PLATES 48, 49 AND 68.

This elegant and well-marked species has apparently been reported only twice, and that practically without notes, since its first description by Peck from plants collected by Underwood at Auburn, Ala. E. M. Williams lists it from Washington, D. C., under date of July 20-28, 1899, adding, "Only a few specimens found" (Asa Gray Bull. 7: 79. 1899); and McIlvaine (One Thousand Am. Fungi, p. 24) reports it from New Jersey and Pennsylvania, July to September, and adds, "This species is edible and quite equal in quality to *A. rubescens*. Great care should be exercised in distinguishing it." Peck's description, while not lengthy, is clear, and agrees well with our Chapel Hill plants, but as the species has been so rarely seen it is listed by Murrill as doubtful (N. Am. Flora 10: 76. 1914), who adds, rightly, that it is near *A. solitaria*. As the species is rather plentiful with us, I have been able to compare it carefully with *A. solitaria*, and remove all doubt, I think, as to its specific distinction.

The plant is an exceptionally handsome one, pure white, firm, and durable, slender, graceful stem on a large abrupt bulb. It is of medium size, growing in mixed woods, from July to October.

Pileus pure white or center straw colored, 4-8 cm. (usually about 5-6 cm.) broad, adorned with rather small sharp warts which are often arranged with beautiful regularity in concentric rings, or may be washed away to a greater or less degree. Between them the cap is smooth and shining. Margin faintly or not at all striate when mature. Flesh thin, white, firm, odorless.

Gills white, not crowded, barely free, and connected with the stem by a line, about 6-7 mm. deep in center.

Veil delicate, but compound and persistent, attached about 0.5 cm. from the top and dropping down like a skirt, or tearing away from the stem and hanging to the gills. The under surface

is attached to the stem for a distance of almost 2 cm. by fibers in expanding, just as in *A. solitaria.*

Stem slender, 7-12 cm. high, including the bulb, 5-12 mm. thick in center, tapering upward, surface white, more or less flocculent-fibrous, flesh solid, firm, with a very distinct central cylinder about 0.5 cm. in diameter, which is firmly stuffed with a kind of pith which immediately becomes water soaked when the cut stem is dipped in water, thus sharply outlining itself from the surrounding material. Bulb large to very large and usually quite abrupt, rounded below and not rooting, its surface quite smooth or somewhat ridged and cracked. The volva is represented below, if at all, only by a low ridge where the stem joins the bulb.

Spores (of No. 757) elliptic, or in some plants mostly spherical, 6-7.4 x 8.2-11 μ.

This is said to be edible by McIlvaine, but it should not be eaten without cautious experimenting.

A. abrupta is nearest *A. solitaria,* but can be easily distinguished by much smoother, more abrupt, and proportionally larger bulb, smaller stem, smaller size, and bibulous central cylinder. In many cases this cylinder does not show to the eye when first cut, but if dipped in water it appears immediately. This peculiarity is constant and will immediately distinguish this species from any other. *A. solitaria* often has a distinct central cylinder permanently stuffed with cotton, but it does not become water soaked when wet. It resembles *A. solitaria* most in the multiple veil, the membranous upper part of which is attached almost at top of stem, and in the firm pyramidal warts on the cap.

153. Battle's Park, near east gate, September 14, 1910.

451. Battle's Park by path to Piney Prospect, September 27, 1912. Photo.

545. Battle's Park, near branch, October 10, 1912. Photo.

757. Woods east of graded school, September 13, 1913. Cap 4.5 cm. broad. Stem, including bulb, 6 cm. long.

760. Battle's Park, September 14, 1913. Two photos. Spores mostly spherical, 7.4-8.3 μ, a few short-elliptic, 5.9-7.4 x 6.6-9 μ. Many plants were seen to-day.

809. Battle's Park, behind Dr. Howe's house, September 21, 1913. Spores short-elliptic, 6.5-7.4 x 7.4-9.2 μ.

1191. Right by branch about ¼ mile above Meeting of the Waters, July 22, 1914. Spores oval with mucro, granular, some also with oil drop, 3.1-5.9 x 6.8-8.5 μ.
1749. Battle's Park, September 12, 1915.
2307. Woods, top of Lone Pine Hill, June 29, 1916.

Asheville, in pine woods. Beardslee.
Flat Rock. Memminger.

23. **Amanita strobiliformis** Vitt.

A. Ravenelii B. and C. *A. radicata* Pk.
A. muscaria var. *major* Pk.

PLATES 50, 51, 52, 53 AND 68.

This is a heavy species with a massive base, and is second only to *A. chlorinosma* in size. The plants may grow scattered or in cespitose groups with their bases connected underground.

In No. 849 the plants were in three groups in an area of a couple of yards. The members of each group were connected from their large radicating bases by thick plates and masses of tissue, the parts below ground being of enormously greater mass and weight than any of our other species. The photos taken of this collection show the structure clearly, but do not show the full extent of the underground tissue.

Cap convex or nearly flat, up to 16 cm. broad (no doubt the largest would have grown broader, had it not been collected when half expanded and allowed to expand in the laboratory), typically covered all over with inherent, flat areolations and patches, more or less concentrically arranged and pinched up in their centers to pointed brown warts, which are largest in center of cap, where they reach a height of 2-2.5 mm., and reduced to nothing on margin. These warts are tightly adherent, and are largest in the button stage. In some cases, as in Nos. 855 and 1097, the warts are reduced to almost nothing, the cap surface being cracked very evenly into small inherent patches. At other times the cap surface may be deeply cracked in large, shingle-like scales (see photo of No. 856). The color of the cap is a light brownish cream, the warts darker. Flesh very firm and dense, about color of ivory, 1.5 cm. deep above margin of stem; a strong smell of chlorine.

Gills a deep cream color, moderately close, scarcely touching stem, deepest in middle, where they are 8 mm. wide.

Veil with a thick marginal roll as in *A. solitaria, A. Atkinsoniana* and *A. abrupta,* not friable as in *A. chlorinosma,* but densely flocculent below as in *A. magnivelaris.* This flocculence is easily rubbed off, but is not composed of minute mealy particles as in *A. chlorinosma.* The veil is attached at the very top of the stem and expanding usually breaks first from the stem, splits into segments and hangs from the cap margin. Its under surface is connected by its flocculence to the upper part of the stem for a distance of about 4 cm. and in tearing away that part of the stem is left covered with a soft dense flocculence, the largest fibers being at the lower extremity. This flocculence is not in the form of large flakes and wisps as in *A. solitaria.* The veil is exactly intermediate in structure and behavior between *A. chlorinosma* and *A. solitaria.*

The stem is very hard and solid all through, its surface covered with a dull, slightly fibrous and scaly layer which cracks and exposes the shining smooth surface below. The stem expands into a very massive and deeply rooting bulb which has no friable meal on the surface, and may be nearly smooth or more commonly covered with concentric plates or shingles pointing upward and perhaps bending outward at the tip. These may be very wide, long, and conspicuous or nearly absent. The appearance of the young button at the top of the massive bulb which projects above the ground is characteristic.

Spores white, short-elliptic or at times spherical, 5.5-7.4 x 7.4-9.2 μ.

Edible. *A. radicata,* a form of this, is said by Ford to contain a small amount of a heat-resisting poison that he thinks similar to that found in *A. phalloides* (Jour. Phar. and Exp. Ther. 1: 283. 1909). However, *Amanita strobiliformis* has been eaten repeatedly by many people and has never hurt any one. It is pronounced among the best by McIlvaine.

These plants here described as *A. strobiliformis* vary in size and shape of bulb, surface of bulb quite smooth to coarsely slivered and shingled. Cap covered with only low inherent slightly pinched

up areas or with high sharp narrow warts in center or with whole surface cracked into deep imbricated scales. The species is closely related to *A. chlorinosma* and they vary toward each other in all of their characters. The former has usually a more massive base and much larger warts than the latter, but the base of *A. chlorinosma* may be very large (see photo of No. 464) and the warts of *strobiliformis* may be almost absent. The most reliable distinction that I can find is the presence of friable meal on *A. chlorinosma* and its absence in *A. strobiliformis,* but even this is not quite constant. In typical plants the veil is less fragile in the latter and is softly tomentose and not friable mealy below. Closely intergrading forms are not common, but every now and then we find plants, as in collection No. 859 (which see under *A. chlorinosma*), so nearly intermediate as to make practically impossible any absolute separation of the two species. As typical plants of the two species are exceedingly different, and much more common than the intermediates I think it best to retain the two species named and acknowledge the intermediates. Where intermediates are more common than the extremes, as in Forms A and B of *chlorinosma,* I have thought best not to make new species.

The *strobiliformis-chlorinosma* group may be distinguished from *A. solitaria* by the very different character of the veil in the two groups, the much larger spores of the latter and the absence in it of the chlorine smell. The veil in *A. solitaria* is strong, compound, and persistent and is not attached at the very top of the stem.

849. In oak grove in front of Dr. Battle's house, September 26, 1913. Five photos. Spores 5.5-6.7 x 7.5-8.2 μ.

855. One plant, dry woods south of Dr. Battle's. Two photos.

This plant has a large, smooth bulb above ground, tapering below to a short root. Cap covered all over with the inherent scaly cuticle which was pinched up only into very small warts even in center. No granular meal. Veil as in No. 849, as were all other points. Spores white, spherical or very short elliptic, 5.5-7.4 x 7.4-9.2 μ.

856. Two plants, dry woods, south of Dr. Battle's, September 29, 1913.

One of these had a long deep-rooting bulb, the other a short, abrupt, shallow-rooting bulb. The first had the cap deeply lacerate scaly, the other cap was as described for No. 849. Spores white, spherical or very short elliptic, 6.5-8.3 μ in diameter.

878. One large plant, in dry woods west side of road to Purefoy's Mill. October 4, 1913. Photo.

In this interesting specimen the marginal part of the veil had remained sticking to the stem when the cap expanded and formed a radially split ring about 6 cm. below the cap. Above this ring the stem showed the characteristic dense, soft and uniform pubescence. That part of the veil from the ring to the very top of the stem has fallen away and disappeared.

911. Oak grove near Dr. Battle's front gate, October 14, 1913. Photo.

1079. Battle's Park, about half way between cemetery and Battle's branch, July 5, 1914.

Asheville. Beardslee.
Blowing Rock. Atkinson.

24. Amanita chlorinosma Pk.

A. candida Pk.
A. polypyramis B. and C.
Amanitopsis pulverulenta Pk.
A. umbella Paulet (in sense of Quélet).
A. lenticularis Fr. (?)

PLATES 54, 55, 56 AND 68.

This is our most protean species, varying greatly in size, color of all parts, even the spores, size of bulb and depth of root, and all extremes are connected with one another by intermediate forms. The large, usually pure white, form reaches a greater size than any of our other Agarics. At the other extreme is its close relative, the small gray plant called *A. cinereconia* by Atkinson. Innumerable gradations which are more abundant than the extremes make it impossible to define species among these forms, but starting from the large white plant as a mean, there are three distinct lines of variation, and in order to reduce the situation to some order I shall call the large white plant the typical *chlorinosma,* and the three variant groups as two forms and one variety of it. One of these forms is ashy olive or ashy umber with a strong tendency to olive spores. This I shall call Form A. The other form is salmon or strawberry in color and is called Form B. Well-marked plants of either form are nearly always smaller than the type. I know of no published American reference to olive gills and spores in this group, but in the Curtis herbarium there is a plant labeled "*Ag. lenticularis* Fr. (?), Hillsboro, N. C., August-September, 1864," to which are at-

tached the following notes: "Cap and stipe wholly covered with a farinose deposit of a pale yellowish-ash color. Gills same color, becoming olive. . . ." This is our *A. chlorinosma* Form A. (Hillsboro is only 13 miles from Chapel Hill.) Beardslee has also noticed the olive gills and spores in Asheville plants. The typical *A. chlorinosma* may be described as follows:

Plant usually chalk-white, solitary or gregarious, and attaining a height of 13 in. with cap 12 in. in diameter. Cap typically white, varying to pinkish brown, usually convex, sometimes nearly plane, margin not striate, covered with a soft friable meal which may extend over the entire cap or may gradually merge toward the center into small, slender, thick set, soft spines or into flat scales. The granular meal is easily removable, but the spines and scales are not. Flesh white and rather soft with a strong odor of chloride of lime.

Gills pallid white (slightly ashy white), not creamy, deepest near the middle, where they are 1.5 cm. wide, just reaching the stem.

Stem white, usually stout and rather long, typically expanded below into a large to very large or rarely reduced bulb, which is usually even or very rarely ridged or cracked, and may or may not be deeply rooted; surface of stem and bulb more or less completely covered with a coarse mealy powder like the cap margin. Flesh solid and fibrous all through.

Veil ample, but very fragile and friable, covered on the lower side with large and small particles of friable meal, the upper side smooth. It is attached to the very tip of the stem, but little or none is left on the plant at maturity, the bulk of it being cast in small fragments on the ground. No trace of a volva is distinguishable except the meal on the bulb, and this is sometimes absent.

Spores (of No. 431) elliptic, slightly larger at one end than at the other, a small eccentric mucro on the large end; 4.8-6.3 x 8.5-10 μ.

Said to be edible by McIlvaine and Mrs. I. M. Jervey. Though said by Ford to contain a small amount of a poison like that in *A. phalloides* (Jour. Phar. and Exp. Ther. 1: 283. 1909).

The only illustrations I can find of *A. chlorinosma* are by Williams in Asa Gray Bulletin 7: Plate 6, 1899; by Hard in The Mushroom, Fig. 22 (as *A. strobiliformis*), which are good and easily recognized as our typical plant; by McIlvaine, Plate 6, Fig. 1, which is less good. On Long Island I have seen the typical *A. chlorinosma,* agreeing well with our southern plant.

I have used Peck's name for this plant because there can be no doubt about his description applying to our large white form, while there is some doubt about other names.

The description of *A. polypyramis* B. and C. (Ann. Mag. Nat. Hist. 32: 417. 1853) might allow it to be either *A. strobiliformis* or *A. chlorinosma,* but after seeing the two plants so named in the Curtis herbarium, I have little doubt that it is a form of the latter, though not the typical large farinose plant. This latter was called by Curtis *A. excelsa* Fr., as shown by a plant in his herbarium, and was so listed in his catalogue of North Carolina plants. This was, of course, a mistake. He also listed forms of *A. chlorinosma* as *A. lenticularis* Fr., with a question as noted above. *A. candida* Pk. (Bull. T. B. C. 24: 137. 1897) is a form of this, and the plants in Peck's collection under this name are just like ours. *Amanitopsis pulverulent* Pk., while small, is also almost certainly a form of *Amanita chlorinosma,* the spores (4.8-5.2 x 8.5 μ, my measurements of the type) agreeing well in shape and size. But *Amanita prairiicola* Peck (Bull. T. B. C. 24: 138. 1897), which is in the *solitaria* group, is not, nor is *A. multisquamosa* Pk. (Ann. Rep. N. Y. St. Mus. 53: 840. 1900), which is very different, and is, I think, *A. junquillea.* Atkinson refers a plant much like *A. chlorinosma* to *A. virosa* in his Studies of American Fungi, p. 61.

A. chlorinosma seems near *A. echinocephala* Vitt., as figured by Paulet (Traite Champ., Plate 163, as *Hypophyllum tricuspidatum)* and by Quélet in Champ. du Jura et des Vosges, Plate 1, as *A. strobiliformis;* and Vittadini in his original description of *A. echinocephala* speaks of the gills being white and becoming green. He says "lamellæ ventricosæ, ex albido-virescens," and again, "dicolor bianco-pallido, virgente al verdognalo" (Descr. Funghi Mang. 346, 1835). But Vittadini described the veil as persistent, distant, not

at all fragile, and he says eaten in small amount it causes vomiting, convulsions, diarrhœa and similar symptoms. All of these characters are different from our plant.

In his monograph on Amanita, Quélet lists *A. umbella* Paulet, and says the spores are green, the odor strong, and that the lamellæ become greenish; and his description in other ways fits our plant pretty well. But Boudier does not think *A. umbella* Paulet distinct from *A. solitaria,* in which he is probably wrong. It seems probable also that *A. lenticularis* Fr. is nearly the same as the greenish form of this species (see below).

147. Battle's Park, near bath house, October 2, 1909.
149. West of Chapel Hill, October, 1909.
150. Woods south of campus, September 15, 1909.
151. Battle's Park, near Indian Spring, October 13, 1909.
176. Behind dissecting hall, September 15, 1910.
309. Woods, Battle's Park, September 29, 1911. Color very light, a slight tint of grayish salmon. This is intermediate between all the forms.
431. Battle's Park, near branch back of Dr. Wilson's, September 26, 1912. Spores elliptic, granular, 4.8-6.3 x 8.5-10 μ.
435. Battle's Park, south of Dr. Battle's, September 25, 1912. Two photos. Largest plant elliptic, 9 x 12 in., color of all good-sized plants was pinkish brown, darkest in center and shading to almost white on edge, surface mealy as well as tuberculate.
464. East of Hillsboro Road, across creek, September 29, 1912. Photo.
540. Battle's Park, back of Dr. Wheeler's, October 10, 1912. Photo.
612. Woods east of campus, October 14, 1912. Photo. Spores elliptic, 7.4 x 11 μ.
792. Battle's Park, September 19, 1913. Spores elliptic, with lateral mucro at one end. 5.5-7.4 x 9.2-11 μ. Plant intermediate between typical white form and olive-buff variety.
799. Battle's Park, back of Dr. Herty's, September 21, 1913. Spores elliptic, 5.5-7.4 x 9.2-11 μ.
858. Dry woods southeast of Dr. Battle's, September 29, 1913.

This collection of two plants was nearly intermediate between *A. chlorinosma* and *A. strobiliformis.* The two plants were alike, one 16 cm. and one 21 cm. broad. The cap was exactly like typical *A. chlorinosma* except that the color was more creamy than usual in the type.

Veil delicately fibrous-flocculent below, hung about 0.5 cm. from the cap, not friable, and not very fragile. Its delicate fibers on under side ran into stem and left a fine flocculence when broken, thus resembling that of *A. strobiliformis.*

Gills ashy gray with tint of flesh in deep view, reaching stem, 4.5 mm.

deep in center; stem flocculent above and light scaly fibrous in middle, the base ending in a small oval white bulb with small scaly warts on upper half and extending a little way up the stem.

Spores cream color, spherical to short elliptic in one plant 6.5-8 x 7.4-9.2 μ, in the other 6.5-8.3 x 7.4-10 μ.

860. Dry woods, Battle's Park, September 29, 1913. Spores white with a touch of cream, elliptic, in one plant they were 5.5-8.3 x 8.3-14 μ; in another, 6.5-8.3 x 7.4-14 μ; in another, 5.5-7.4 x 8.3-13 μ; in another, 6.5-7.4 x 9.2-12 μ. These were all typical, pure white large plants.

1826. Upland woods, Battle's Park, September 18, 1915. Photo.

This plant had a perfectly *smooth, shining* cap, no trace of meal or warts, although it had not rained for ten days. Stem bulbous, bulb and stem covered with mealy stuff, of a slightly greenish tint on bulb. Usual chlorine smell. Gills dusty cream.

Blowing Rock. Atkinson.
Asheville. Beardslee.
Montreat, July 6, 1915. Coker.

24*a*. **Amanita chlorinosma** Form A. Ashy Olive-buff.

A. umbella Paulet (?) *A. lenticularis* Fr. (?)

PLATES 1, 57 AND 68.

This is the smallest and most extreme form of *A. chlorinosma*, and is distinguished by its usually smaller size, its peculiar ashy-olive or ashy-buff color with deep blue-green stains on the bulb (as a rule), and the color of the spores which are not white but olive buff or ashy buff (usually), or cream colored (occasionally). The bulb is usually even and covered with meal, but is sometimes marked with small scales. Extremes of this form approach near *A. cinereconia* of Atkinson, but in that species the cap is distinctly umber, and the spores are white.

In his catalogue Curtis lists *A. lenticularis* Fr. with a question mark. I have examined the plant so labeled in his herbarium and find it to be this form of *A. chlorinosma*.

A complete series of variations connect the extremes with the typical *A. chlorinosma*. I give below notes on several of the collections.

Collection No. 308 was pallid ashy olive in color all over, including the gills; bulb with a very slender root; pyramidal warts

mixed with soft meal on cap; greenish stains on bulb; gills lavender tinted in certain angles. Spores cream colored, 6-7.5 x 9-11 μ.

No. 314 was like No. 308 except that the remains of the volva were washed from the center of the cap by rains; the surface being frosty looking on the marginal half and smooth in the center. Color of cap nearly white, but stem a pallid ashy gray, farinose and green tinted below as in No. 308; gills exactly as in No. 308; stem rooting very deeply (11 cm.), and slender; no sign of volva on bulb; veil entirely gone; spores ashy gray, elliptic, 8 x 11 μ on average.

No. 460 was very near *A. cinereconia.* Cap. 5 cm. broad, convex, smooth, not striate, covered like the veil and stem with a soft friable meal that is light brownish gray in color. When this is rubbed off it exposes the very smooth and shining cap surface, which is about the same color. Gills not crowded, close, but free from stem, color of cap. Veil very fragile, soft-friable below, attached at very top of stem, breaking away from the stem, where it leaves a line at top and hanging usually in large torn fragments to the margin of the cap, falling away when disturbed just as in the typical form. Stem 9 cm. long above ground, 9 mm. thick in center, tapering upward, extending into the ground at least 15 mm., covered above by soft meal which in this connection had disappeared in lower part. At ground and a little above the stem was stained with greenish-black lines and dots, which, while distinct, were not conspicuous, no bulb, but largest at the ground. A distinct smell of chloride of lime just as in *A. chlorinosma,* but not so strong.

September 19, 1913, a very perfect specimen was brought in (No. 791, apparently lost). Cap 7.5 cm. in diameter; stem and bulb 12 cm. long; color of cap and stem an ashy buff; gills superficially this color, but much darker in bulk; bulb stained with green just as in No. 308; odor of old ham; cap, stem, and bulb covered with friable, easily removed meal. Spores *olive buff,* short elliptic, 6.5-9.2 x 8.3-11 μ. Veil very fragile and cast to the ground. Another plant (No. 729, entered by number under type) was exactly intermediate between the above and typical *A. chlorinosma.* Its cap

was a light creamy tan in center, white on margin; gills exactly intermediate between white and the color above; that is, they are grayish cream; stem and bulb covered with small scales that are not friable; spores cream color, elliptic, 5.5-7.4 x 9.2-11 μ. In the scaly bulb this also approaches a little toward *A. strobiliformis,* as does also Nos. 858 and 1320.

308. In woods south of "The Rocks," September 27, 1911.
351. Woods under pines near Howell's Spring, October 11, 1911. Ash gray in color; stem greenish below; gills light cinnamon color with a tint of lavender at certain angles. Spores 4.8-7.4 x 9-11 μ.
460. On side of hill to left of upper path to Piney Prospect, September 30, 1912. Photo.
858. Dry woods southeast of Dr. Battle's, September 29, 1913. Bulb covered with rings of small scales.
1253. In poor, rather dry soil in mixed woods east of graded school, September 13, 1914. Painting.
1320. Battle's Park, woods southeast of Dr. Battle's, October 9, 1914. Bulb covered with rings of small scales as in No. 858, otherwise typical.
2374. By path along Battle's branch, just east of Dr. Battle's home, July 8, 1916.

24*b*. **Amanita chlorinosma** Form B. Red or Salmon.

A. megalodactyla Berk. (?)

This is a less extreme variant than Form A, and even when pronounced differs from the type species in scarcely more than smaller size and reddish color. The following brief notes will sufficiently describe it.

Collection No. 309. All parts of the volva a light salmon color; pileus covered with light salmon granules and pyramidal warts, the large bulb salmon colored on the surface; stem, gills and veil white; veil not broken up, but hung a perfect, thin delicate skirt from the very top; under side of veil covered with white meal, the granules not easily rubbed off. Spores 5.5 x 8.3 μ.

Collection No. 833. Smaller than the type. The friable meal on cap reddish brown; bulb and lower half of stem same color; upper half of stem, veil and gills white; veil very friable and falling off as usual; smell of ham. Spores white, elliptic, 5.5-7.4 x 9.2-11 μ.

Collection No. 838 was distinctly of this form; color of bulb and

lower stem nearly strawberry red, a pinkish red; color on cap had faded to a more brownish red.

Collection No. 925 was just like No. 838: cap 10 cm. broad, color of cap and bulb a rather light rosy red. Spores elliptic, 4.6-6.5 x 7.4-9.2 μ.

Plant No. 1128 was 8.5 cm. broad, light ochraceous buff to brown buff (Ridgway), densely soft-mealy in center, less densely so at margin; stem densely mealy, light creamy buff, the bulb large, long and nearly smooth, nearly color of cap; veil, as usual in this species, very fragile, covered below with soft, creamy-buff meal like the stem.

309. Battle's Park, back of Dr. Pratt's house, September 29, 1911.
833. Battle's Park, September 23, 1913. Photo.
838. Battle's Park, September 25, 1913.
925. Battle's Park, back of Dr. Pratt's house, October 16, 1913.
1128. Oak grove southwest part of "The Rocks," July 13, 1914. Photo.
1212. By path on right side of Bowlin's Creek, below "Fern Banks," July 25, 1914.
1570. In clay bank south of power house, June 23, 1915.

25. Amanita virosa Fr.

PLATE 68.

Cap about 5 cm. wide, evenly convex, quite smooth, shining, viscid, pure white; margin not striate. Flesh white, about 5 mm. thick in center, mild, a distinct but not strong odor of chlorine.

Gills about 6 mm. wide, moderately close, just reaching the stem, pure dull white.

Veil fragile and friable, attached at very top of stem, fragmenting into tatters and slips.

Stem solid, tapering slightly upward, squamulose-scurfy, ending below in an oval bulb, which is margined at the top by a *distinct, circular and even volval ring* about 3 mm. high.

Spores elliptic, smooth, 4.4-5.5 x 7.5-8 μ, a few up to 9 μ.

The entire plant is white and is related to *A. chlorinosma,* from which it differs in the entire absence of friable meal on cap, stem, or volva, in the distinct volval cup margin at the base, and in the smaller spores. The presence of a persistent volval cup places this

plant in complete harmony with descriptions and figures (Cooke, Gillet, Paulet) of the European *A. virosa*.

Amanita virosa of Europe is said to be poisonous and Ford has found a plant from Massachusetts, determined as this species, to contain the same deadly poisons as *A. phalloides* (Jour. Phar. and Exp. Ther. 1: 281. 1909). It is, however, doubtful if his plants were of the same species as the one I have here described.

Hartsville, S. C., No. 10. Low woods under long-leaf pine, southeast side of Hartsville plantation, September 9, 1916. Plants lost (burned up by the cook), but spore prints saved.

26. **Amanita Atkinsoniana** n. sp.

PLATES 58, 59 AND 68.

Cap about 8 to 10 cm. wide, convex, plane, or sometimes depressed, margin even or sometimes striate, particularly after rains; surface warty in center, the warts numerous or scattered, usually about 1.5 mm. wide at base and short pyramidal; toward the margin the warts merge into soft patches or soft flocculence, both warts and flocculence easily removable by rain; warts, flocculence and center of cap a strong ashy brown (about Prout's brown—Ridgway), cap fading on margin to pallid cream. Flesh about 0.5 to 1 cm. thick near center, soft and spongy, white or with a tint of flesh color; a decided odor of chloride of lime.

Gills not crowded, just reaching stem, broadest in center or near the outer end, 5-8 mm. wide. Color pure white or creamy and sometimes stained with light reddish brown.

Veil delicate and fragile but not friable, very softly flocculent on upper side, more fibrous-flocculent below, on breaking leaving a fringe on the margin of the young cap, and forming a soft collapsed ring near top of stem, which usually soon deliquesces and flattens down to a thin yellow membrane.

Stem up to 11 cm. long above ground, 1-1.8 cm. thick in center and tapering upward, ending below in a variable bulb, sometimes quite large, at others very small, which is short or with a moderate root, the upper part covered with patches of reddish brown

(Prout's brown) soft flocculent warts which are usually arranged in more or less regular close-set rings, and extending up the stem, getting smaller and fading finally into a delicate fibrous layer that disappears on the upper parts of the stem. Flesh of stem solid and fibrous.

Spores nearly pure white (slightly creamy), no tint of olive, elliptic, 5.2-8.3 x 7.4-11 μ, most about 6.3 x 9 μ.

This plant is evidently in the *A. chlorinosma* group and is most like Form A of that species, but it differs from all others in the color of the plant, the absence of friable meal on cap, stem and veil, the rings of small warts on the stem base, and the at least somewhat less fragile character of the veil.

The species is well marked, and we have not found clearly intermediate forms between it and other members of the chlorinosma group.

759. Battle's Park, September 14, 1913. Photo. Four plants. Type.
Cap warty and flocculent, brownish ash color; bulb marked by rings of warts of same color or nearly smooth; not pruinose. Spores white, short elliptic, 5.6-7.4 x 8.5-11 μ.

824. Woods, Chapel Hill, September, 1913.
Spores 5.2-8 x 7.7-10.8 μ.

837. Dry woods, Battle's Park, September 25, 1913. Photo.
These two plants were exactly as described for No. 824 except that in one the only remnant of the veil was a torn, irregular soft fringe about 3 mm. wide hanging to the margin. It is not as friable as in *A. chlorinosma*. Spores elliptic, white, 6-8.1 x 7.2-9.9 μ.

857. Dry mixed woods, southeast of Dr. Battle's, September 29, 1913.
One plant. Color reddish brown, center with sharp warts; margin with warty scales, silky-shiny between the warts and scales; part of the veil hanging to margin, part collapsed to a yellow membrane against stem; a strong smell of old ham; gills broadest in center, where they were scarcely 5 mm. deep; white on flat surface, reddish yellow on margin where they were beginning to dry.

870. Mixed woods southeast of graded school, October 2, 1913. Two photos.
Cap brown, nearly white on margin, warted and flocculent; gills pure white, reaching stem 7 mm. deep in center. Veil delicate, flocculent, not friable, leaving a beautiful fragile fringe on margin of cap and a ring on stem about 1.5 cm. from top. Stem pure white above veil, marked with brown lines and stains below, solid, not stuffed, enlarging evenly to a good-sized long bulb which is circled at top by rings of low, soft, brown warts. Spores white, elliptic, a large oil drop, 5.5-7.4 x 7.4-11 μ.

27. **Amanita cinereconia** Atk.

PLATES 60, 61 AND 68.

Cap 3-5.8 cm. broad, irregularly plane, not at all striate, covered densely in center with a soft, more or less coherent meal of a distinct umber color (about Saccardo's umber of Ridgway), which becomes thin toward the nearly white margin; not viscid. Flesh pure white, soft, about 3-4 mm. thick at stem, almost tasteless, but with a distinct odor of chlorine as in *A. chlorinosma.*

Gills rather close, slightly attached, about 5 mm. wide, white then creamy in age, not dusky.

Veil soft, friable, remaining in part as pendants on the cap margin and in part as an imperfect and easily broken deciduous ring from the top of the stem.

Stem solid, 5-8 cm. long, including the root, about 5-7.5 mm. thick in center, nearly equal but expanding at the cap, and enlarging below more or less suddenly into a tapering root about 1.5-3 cm. long; surface densely covered near the ground with umber meal as on the cap, which extends more thinly over the entire stem; flesh solid.

Spores (of No. 2391) *white,* elliptic, smooth, 4.4-5 x 7.4-8.5 μ.

This species is nearest the olive buff form of *A. chlorinosma,* but is different enough to be treated as distinct. The main points of difference are the smaller size, distinctly *umber* color with absence of green, and the *white* spores. It differs sharply from *Amanitopsis farinosa* in the umber color, presence of a veil, pointed, rooting base, larger spores and even margin. The original description by Atkinson was made from plants collected by us in Chapel Hill, in 1908 (Ann. Mycologici 7: 366. 1909). In this description the odor was not mentioned, but fresh plants show it to be that of old ham as in other members of the *chlorinosma* group.

300. Woods south of Dr. Battle's, September 25, 1911. Photo.
2391. Oak and pine woods, hillside near barn, Glenn Burnie Farm, July 18, 1916. Two photos.